FOUNDED BY DR. MAX THOREK

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General Surgery

Degastroenterostomy

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DEGASTROENTEROSTOMY — removal of a gastroenterostomy—is an operation that ought to be obsolete, but until the results of gastric operations attain a level of 100 per cent effectiveness, it will behoove surgeons to retain an intimate familiarity with this procedure.

Indications.—In discussing degastroenterostomy, one must assume that gastroenterostomy has been done for peptic ulcer, real or phantom. Degastroenterostomy consists of removing an existing gastroenterostomy for the following indications: (1.) malfunction of the anastomotic stoma, (2.) secondary peptic ulcer occurring at or about the stoma, or (3.) gastrojejunocolic fistula.

Read before the Illinois Surgical Society, Galesburg, Aug. 25, 1956, the Illinois Chapter of the American College of Surgeons, Belleville, Sept. 29, 1956, and the North Central Illinois Medical Association, Princeton, Nov. 18, 1956.
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1. Malfunction of a gastroenterostomy includes (a) vicious circle, (b) a contracted stoma with gastric retention and (c) a wide open stoma without vicious circle complications, without secondary peptic ulcer but with gastric retention.

In most instances the cause of malfunction can be traced to an improper indication for the operation or improper performance of the anastomosis. Occasionally, however, despite proper indications and performance, patients have disturbing symptoms due to gastric retention, regardless of an open stoma and the absence of secondary peptic ulcers. This condition was formerly known to surgeons as "gastroenterostomy disease" for lack of a better name. I suppose that the disturbance is associated with imbalance of the neuromuscular apparatus of the stomach, but I confess that this may be just an-

other way of saying that nothing is known of the cause.

In any event, a surgical operation must be performed as soon as possible. If a circulus vitiosus is present, the degastroenterostomy should be removed and a revision of the anastomosis performed, so that the food will leave the stomach by the efferent rather than the afferent loop. This procedure might be quite justifiable if the patient had an obstructive peptic ulcer or if vagotomy and gastroenterostomy had been performed for the original peptic ulcer.

a. If the original operation was done for an unconfirmed ulcer with no other pathologic change, degastroenterostomy with suture of the stomach and jejunum is sufficient.

b. For a contracted stoma, revision of the stoma and the addition of vagotomy or degastroenterostomy and gastric resection may be done.

c. For so-called "gastroenterostomy disease" in a patient with a previously demonstrated peptic ulcer but without demonstrable pathologic change on exploration, the management preferred degastroenterostomy and formal gastric resection.

2. It is well known that in 15 per cent of patients with peptic ulcers (usually duodenal), for which gastroenterostomy has been performed, secondary peptic ulcers develop at or about the stoma. The result is a condition more serious than the original lesion. Some surgeons do a vagotomy to correct this condition; others, probably a majority, prefer to do a degastroenterostomy and follow it with a formal 70 to 75 per cent gastric resection. There is no purpose in applying medical treatment except to prepare the patient for surgical intervention.

3. The third indication for this procedure is gastrojejunocolic fistula. This condition is an extension of the disease process that follows the development, as a complication of secondary peptic ulcer in a previously existing gastroenterostomy. Perforation of an adherent jejunal ulcer into the colon gives rise to this rather unusual and devastating condition. Many factors require attention and consideration in the management of this pathologic entity, but there is general agreement that there is no palliative or effective medical treatment. Surgical intervention is the only hope. It must include separation of the gastrojejunal stoma and the jejunocolic fistula, with reconstruction of the jejunum or colon and the performance of a formal 70 per cent gastric resection.

REPORT OF CASES

CASE 1.—A man aged 48 first consulted me on Dec. 28, 1948, because of a perforated duodenal ulcer with massive hemorrhage. A McNealy tamponade of a bleeding duodenal ulcer was done; it was followed by an anterior gastroenterostomy and a vagotomy. The lesion was an obstructing callous ulcer in the first portion of the duodenum.

After the operation, an insulin gastric analysis showed complete absence of free hydrochloric acid; temporary diarrhea developed. Clinical improvement was obvious from the start, but some discomfort in the right lower portion of the abdomen developed a year later. There were episodes of postprandial gas, borborygmi and abdominal distention, which were attributed to the vagotomy. A gastrointestinal roentgenographic recheck showed a well-functioning anastomotic stoma with no gastric retention and no evidence of jejunal ulcer.

The patient apparently progressed reasonably well for four years thereafter, during which there were no observations. He then appeared with moderate symptoms of hematemesis and of blood in the stools three weeks after the development of epigastric pain, nausea and vomiting. He was hospitalized, and an exploratory operation was done. Adhesions were separated in and around the anastomosis. Only the scar of the old duodenal ulcer could be found. The stoma was examined through a gastrotomy incision, but I found a perfectly open stoma with the

afferent and efferent loops in good relation and no evidence of a secondary peptic ulcer. At that time I did not consider a radical procedure justifiable, and the operation was completed by closing the gastrotomy wound.

For the next year the patient complained of occasional stomach trouble, characterized principally by belching. Toward the latter part of the year there were recurring attacks of pain in the right upper part of the abdomen, accompanied by belching and flatulence. The patient had occasional diarrhea and lost weight. Roentgen studies of the upper part of the gastrointestinal tract showed unexplained 40 to 50 per cent retention of gastric contents (Fig. 1).

Gastric resection was recommended and undertaken. A degastroenterostomy, reconstruction of the jejunum and a gastric resection with an anterior end-to-side gastrojejunostomy were done (Fig. 2). No sign of the original duodenal ulcer or a secondary jejunal ulcer could be found. No mechanical cause was seen for the malfunctioning gastroenterostomy. In the postoperative period, considerable time elapsed before the patient had stabilized himself so as to drink and eat without regurgitation. I do not know what the final outcome of this case will be, but since August 1, 1955, the patient has remained stabilized.

CASE 2.—A man aged 61 presented himself on Nov. 30, 1954, with the following symptoms: (a) loss of 40 pounds (18.1 Kg.) in the preceding five months; (b) change of bowel habits (he had formerly been constipated, but for the past four months, his stools had been watery, light and frequent; sometimes the food, such as milk, sausage, celery, olives and green vegetables, would go through unchanged); (c) poor appetite, frequent vomiting and fetid belching in the past four months, and (d) progressive loss of strength and energy.

The most significant thing in his history was an operation performed at the Mayo Clinic thirty years earlier for "ulcers and gallbladder." In the years that followed the patient's initial relief gave way to recurring complaints of gastric distress. It was relieved somewhat by antacids, but in recent months these had failed to relieve him. He had maintained a fair degree of occupational usefulness until five months prior to consulting me.

Physical examination revealed the patient to be tall, depleted and cachectic, with a dispirited, resigned attitude. Apart from the presence of an old paramedian scar over the right upper portion of the abdomen, however, nothing of significance was discovered.

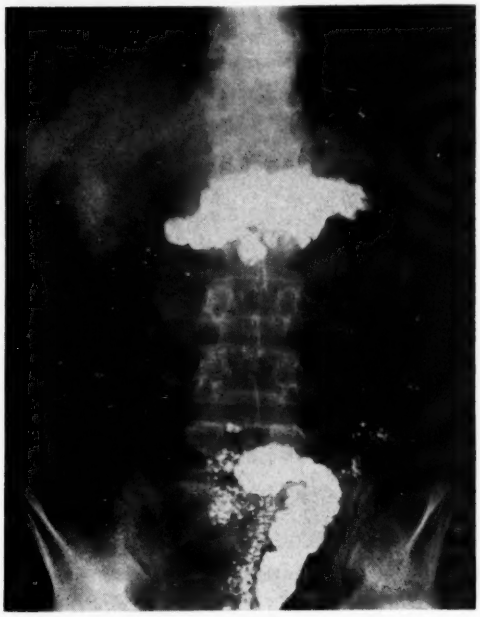

Fig. 1.—Roentgenogram showing 40 to 50 per cent five-hour retention of gastric contents.

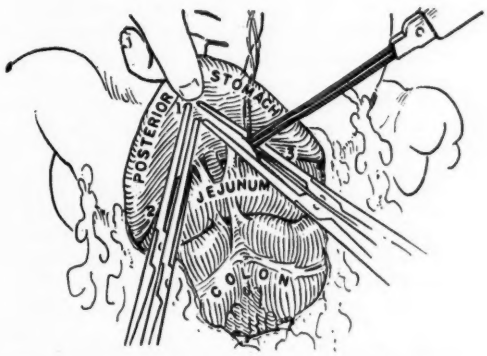

Fig. 2.—Approach to degastroenterostomy by a shallow V resection between clamps at the expense of the stomach. (After Pfeiffer.)

Because of the change in bowel habits, a roentgen study of the colon was done first. The roentgenographic appearance suggested that an upper gastrointestinal roentgeno-

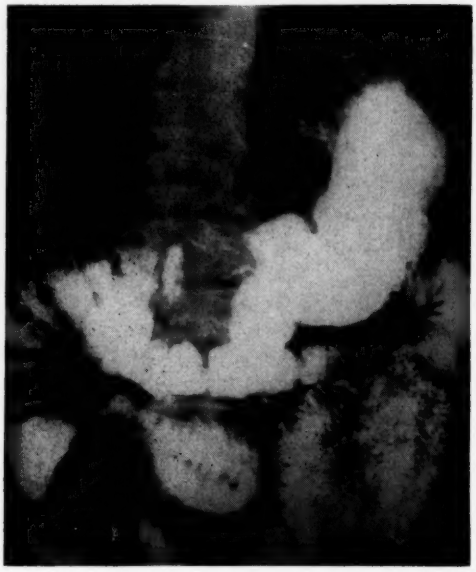

Fig. 3.—Roentgenographic appearance after a barium enema in a case of gastrojejunocolic fistula.

graphic series had been done, as the stomach was excellently filled and the barium was plentifully distributed from the stomach to the rectum (Fig. 3). Although a gastrointestinal roentgen study was done later and confirmed the observations, the diagnosis was already clear—gastrojejunocolic fistula.

Management. — Management presented a number of problems. The patient obviously had severe hypoproteinemia, advanced hypovitaminosis and a disturbed fluid balance due to inability to absorb his nourishment. For the same reason, hemoconcentration was present.

After those factors had been reasonably controlled, surgical intervention offered him his only hope.

Choice of Procedures.—Several procedures could be considered:

1. Degastroenterostomy, separation of the jejunum and the colon with suture of each viscus and a later gastric resection.
2. Resection of the transverse portion of the colon, the jejunum and the stomach *en bloc* in one stage and reanastomosis of the jejunum and the colon.
3. Lahey's ileodescending colostomy followed by a later stage consisting of resection *en bloc* of the stomach, the jejunum and the right half of the colon to the distal third of the transverse portion.
4. Pfeiffer's three stage operation:
   - Stage 1 Ascending double-barreled colostomy.
   - Stage 2 Degastroenterostomy. Separation of jejunocolic fistula; reconstruction of the jejunum and transverse portion of the colon; gastric resection and end-to-side gastrojejunostomy.
   - Stage 3 Closure of ascending colostomy by Mikulicz' spurcrushing technic.

Of these four methods, I chose the Pfeiffer method, because I consider it the safest. True, more time must be allowed for completing the three stages. In this instance it took seven months (Fig. 4).

Operation in Stages.—The importance of the double-barreled ascending colostomy cannot be overestimated. This procedure diverts the fecal current completely away from the gastrojejunocolic fistula.

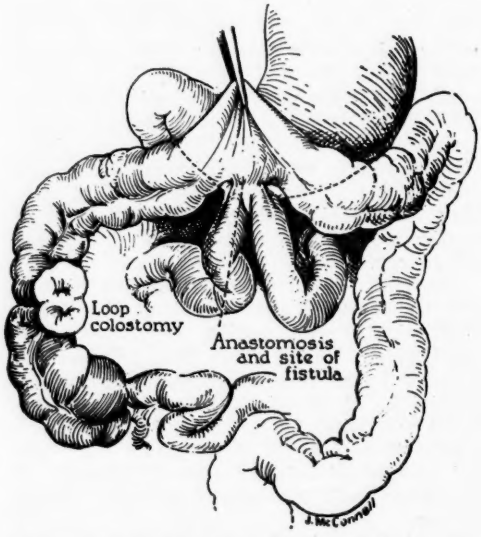

Fig. 4.—Double-barreled ascending colostomy constituting first stage in repair of gastrojejunocolic fistula. (After Pfeiffer.)

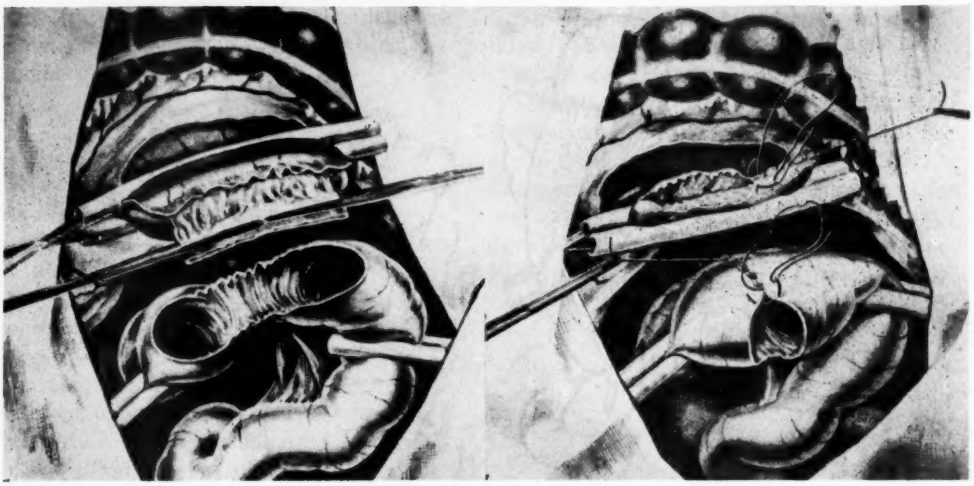

Fig. 5.—*Left*, degastroenterostomy and excision of gastrojejunal stoma. *Right*, reconstruction of jejunum. (After Spivack.)

This maneuver, coupled with the use of Upjohn's mycifradin, which sterilizes the intestinal contents, permits the inevitable inflammatory reaction around the fistulas to subside materially. During the interval of three or four months before the second stage, this patient lost his toxic feeling and appearance and began to believe that there was some hope. The presence of the colostomy is admittedly a nuisance during the entire course of the management, but it must be borne. A course of mycifradin was given for three or four days before the second stage.

In the second stage one will encounter many adhesions in and around the fistulas, and they must be reduced so that one can identify the abnormal fistulas. This is particularly difficult if a retrocolic gastrojejunostomy has been done, as in this case. I noted that the location of the gastrojejunal anastomosis is most easily found and its disengagement most readily performed if one enters the lesser peritoneum through the gastrohepatic omentum first. The attachment of the transverse mesocolon to the stomach must be separated, with constant awareness that the middle colic artery must not be injured. Manipulation, from above as well as from below the transverse mesocolon, will keep one more conscious of the relations and will reduce this hazard. The stomach above the anastomosis is divided between two crushing clamps so as to liberate the gastrojejunal anastomosis, still attached to the jejunum, at the expense of the stomach (Fig. 2).

The site of the jejunocolic fistula is then cleared of adhesions, and two series of clamps are placed in wedge-shaped fashion over the transverse portion of the colon on each side of the fistula beyond the limits of palpable induration. The defect in the transverse portion of the colon is then sutured in a transverse direction. Because of the diversion of the fecal current by the ascending colostomy and the sterilizing effect of the mycifradin, one need not fear contamination (Fig. 4).

The jejunal loop is then opened, and the areas of the gastrojejunal anastomosis

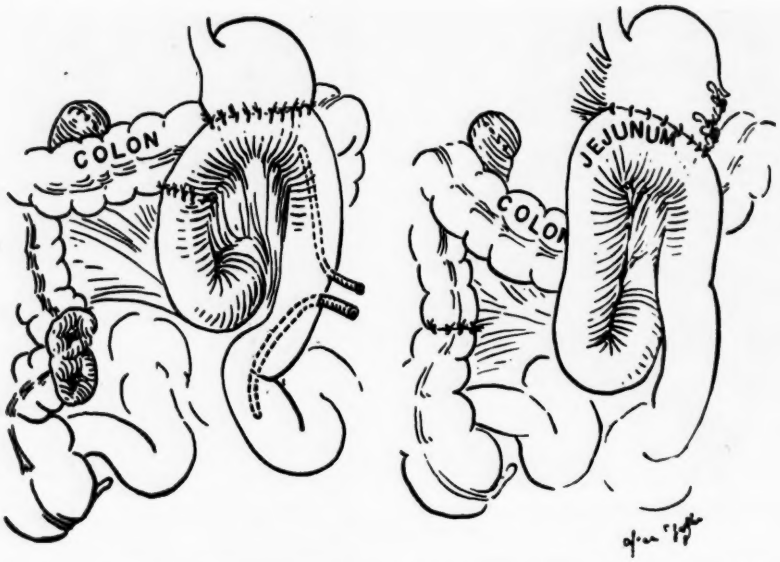

Fig. 6.—*Left,* gastric resection; antecolic end-to-side gastrojejunostomy (Hofmeister); inversion of duodenal stump; jejunostomy. *Right,* closure of double-barreled ascending colostomy after Mikulicz' spur-crushing procedure. (After Pfeiffer.)

and the jejunocolic fistula are excised. As a general rule, the mesenteric portion of the jejunal wall can be preserved and the defect in the jejunum can be sutured transversely so as to obtain a wide lumen (Fig. 5). At times, however, resection of the jejunum, with an end-to-end anastomosis, must be done (Fig. 6, left).

After completion of this step, a standard gastric resection is done with division and suture of the duodenum ¾ inch (1.9 cm.) beyond the pylorus. It is followed by an antecolic Hofmeister end-to-side gastrojejunostomy with the proximal portion of the stomach (Fig. 6, right).

The Levine suction tube is removed on the fifth postoperative day. In this instance the patient was discharged on the twelfth day. About five weeks later spur crushing of the double-barreled colostomy was done, and six weeks thereafter the colostomy was closed so as to restore continuity of the bowel. The incision fortunately healed by first intention. The subsequent progress of the patient was remarkably gratifying. He regained his weight rapidly and one year later was back at his regular work as a crane operator.

SUMMARY

Degastroenterostomy — removal of a gastroenterostomy—is an important part of an overall procedure seeking to cure (a) malfunctioning anastomotic stoma, (b) a secondary peptic ulcer occurring at or about the stoma, or (c) a gastrojejunocolic fistula.

Factors in management and the principles of treatment are outlined. Possible procedures, the choice among them and their relation to 2 reported cases are discussed. The details of degastroenteros-

tomy and of the Pfeiffer multistage method for gastrojejunocolic fistula are described.

RÉSUMÉ

La dégastro-entérostomie est une partie importante de la thérapeutique des affections suivantes: a) mauvaise fonction d'un stoma anastomique; b) ulcère peptique secondaire au niveau du stoma; c) fistule gastro-jéjuno-colique.

Les facteurs et les principes du traitement sont exposés. Le choix des procédés est discuté à l'appui de deux cas. Description des détails de la dégastro-entérostomie, et de la technique en plusieurs temps selon Pfeiffer pour la fistule gastro-jéjunocolique.

SUMARIO

A degastroenterostomia—a remoção de uma gastroenterostomia — é um método importante para solucionar:

a) a disfunção de um stoma anastomótico; b) uma ulcera péptica secundária que se tenha estabelecido no ou em volta do stoma; c) a fístula gastro-jejuno-cólica.

Os fatores relativos ao tratamento e seus principios são apresentados no trabalho. São discutidos os metodos em relação aos dois casos. Pormenores da degastroenterostomia e o método de estagios múltiplos de Pfeiffer para a fístula gastrojejuno-colica são descritos.

ZUSAMMENFASSUNG

Die Degastroenterostomisierung, d.h.die Entfernung einer Gastroenterostomose, bildet einen wichtigen Teil eines Gesamteingriffes, der die Heilung der folgenden Krankheitszustände zum Ziel hat:

a) Fehlerhafte Funktion der Anastomosenöffnung.

b) Sekundüres peptisches Geschwür an oder in der Nähe der Anastomose.

c) Gastrojejunokolische Fistel.

Die Einzelheiten und die Grundsätze der Behandlung werden umrissen. Die Möglichkeit der Auswahl unter verschiedenen Massnahmen wird erörtert und an Hand von zwei Fällen erläutert. Die Einzelheiten der Degastroenterostomisierung und der Pfeifferschen Behandlungsmethode der gastrojejunokolischen Fistel in mehreren Stadien werden beschrieben.

RIASSUNTO

La degastroenterostomia, cioè la demolizione di una gastroenteroanastomosi è il tempo principale di qualunque metodo diretto a curare (a) uno stoma non funzionante; (b) un'ulcera recidiva sull'anastomosi e (c) una fistola gastrodigiunocolica.

Vengono elencati i metodi e le loro basi, gli elementi di scelta del tipo di intervento e i rapporti con i due casi presentati. Viene descritto l'intervento di degastroenterostomia e il metodo in più tempi, di Pfeiffer per la cura della fistola gastrodigiunocolica.

RESUMEN

La degastroenteroanastomosis ó extirpación de una gastroenteroanastomosis, es una parte importante de un procedimiento que persigue la curación de: a) un estoma que no funcione; b) úlcera péptica secundaria cerca ó en el estoma; c) fístula gastrojejuno cólica.

Se enumeran los factores que influyen en el manejo de estos casos y sas principios. Se discute la selección de los procedimientos y su relación a dos casos reportados. Se describen los porryenores de la degastroen teroanastomosis y del método de Pfeiffer envarios tiempos para el tratamiento de las fístulas gastrojejuno cólicas.

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CORRESPONDENCE

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Dr. Max Thorek, Editor
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Dear Dr. Thorek:

I have read the article by Dr. Longacre and his collaborators, entitled Repair of Defects of the Skull with Autogenous Tissue and published in the March issue of the Journal.

On page 324 in this article, the authors state that "Scott and Wycis reported a failure rate of 18 per cent when stainless steel was used for cranioplasty." The authors give as a reference for this statement a paper published by us in 1946 in the Journal of Neurosurgery. This article is entirely on the experimental use in animals and makes no references whatsoever to any results in its use in humans.

In February, 1951, we did publish our results on Stainless Steel Cranioplasty in humans in the Journal of the International College of Surgeons, Vol. 15, No. 2, p. 161. We reported our experience in 22 cranioplasties and found the material to be eminently satisfactory and at that time 1/300 as expensive as tantalum plate. The incidence of plate removal was 9 per cent.

Finally, in September, 1956, we published further follow-up studies on stainless steel cranioplasty in the American Journal of Surgery, Vol. 92, No. 3, p. 393. In this report, we gave our results on a series of 46 stainless steel cranioplasties in man, 27 of which were followed five years or more. Again we found the material satisfactory and considerably cheaper than tantalum or acrylics, and our incidence of plate removal was 6.5 per cent, which compares favorably with the 8 per cent incidence of tantalum plate removed in a series of 128 tantalum cranioplasties reported by Lewin and others.

Sincerely,

Michael Scott, M.D.

Studies of the Use of Glyco-Algin as a Solution for Transfusion

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THE transfusion of fluids is administered mainly to achieve two ends: first, to restore the water deficiency of the body, and second, to supplement nutritional deficiencies. In addition, transfusion is employed to treat shock induced by severe trauma or major operations, and also as a blood substitute or an expander of plasma volume. In other words, various fluids are administered by transfusion to chronically dehydrated patients preoperatively, during operation and postoperatively, especially when the amount of blood required for transfusion is not available in cases of unsuspected great emergency and/or when various nutrients must be supplied.

Hitherto saline solution, Ringer's solution and 5 per cent dextrose have been commonly used to restore body fluids. It has been revealed recently, however, that a limit exists to the amount of fluid administered and that saline solution causes a disturbance in water metabolism, influences the electrolyte balance and, above all, may be the cause of pulmonary edema and other dangerous complications. To counteract these, Darrow's solution, Dextran and other medicaments have been introduced. Nevertheless, the problem of fluid transfusion has become more urgent with the progress of operative technic and the increase in the number of operations performed.

With the foregoing facts in mind, I have made chemically pure Glyco-Algin from sodium alginate, to be used in transfusions for dehydration, as a blood substitute and as a so-called plasma volume expander (Bowman).

These studies were begun in 1948 and completed in 1951.

Chemical and Biologic Properties of Sodium Alginate: Alginic acid, a polymer of a mannuronic acid, is chemically a polysaccharide and has a high molecular weight. Sodium alginate has a colloidal property, is soluble in water and has high viscosity. The structure of alginic acid is shown in Figure 1.

Glyco-Algin is prepared by dissolving 0.3 per cent sodium alginate in 5 per cent dextrose solution. It is adjusted to maintain a specific viscosity of 2 and a molecular weight of 15,000. This is because polysaccharides of high molecular weight, such as Dextran, have an unfavorable influence on the living body; moreover, solution of sodium alginate alone has been verified as having a somewhat ill effect on hemotasis.

When mature rabbits were bled at the rate of 20 cc. per kilogram of body weight in six minutes, the blood pressure dropped rapidly. With the systolic pressure at 100 prior to bleeding, the changes of blood pressure appeared as in Figure 2. The rabbits were then given transfusions of Ringer's solution, dextrose solution, alginate saline solution and Glyco-Algin respectively, in an amount equal to the blood removed, and the results compared with data on groups that received no transfu-

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Read at the Twenty-First Annual Congress of the United States and Canadian Sections, International College of Surgeons, Chicago, Sept. 9-13, 1956.

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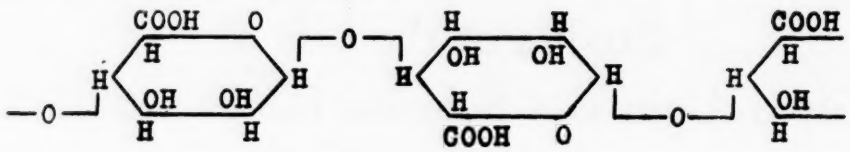

Fig. 1.—Structure of alginic acid.

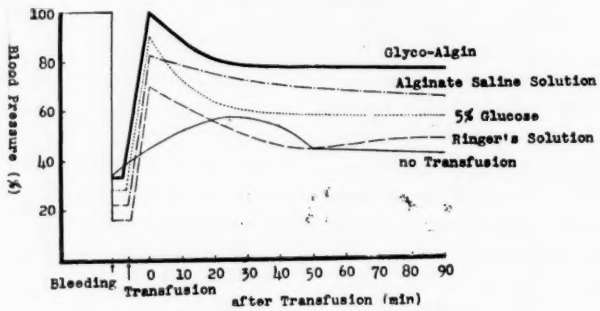

Fig. 2.—Changes in blood pressure.

sions. The results are shown in Figure 2.

The systolic blood pressure level rose 95 per cent after the transfusion of Glyco-Algin, and even after a ninety-minute lapse it was maintained at 80 per cent. Even when Glyco-Algin was transfused intravenously at a rapid rate (Fig. 3), respiration was normal in spite of the rise in blood pressure and no symptoms of colloidal shock were observed.

It can be said that Glyco-Algin has no undesirable effects on the living body. The ideal of transfusion is to increase the volume of circulating blood and the plasma volume without changing the level of extracellular fluids. With this in mind, each

Comparative Results

			After 20'		*After 60'*	
		Before (Cc./Kg.)	*Cc./Kg.*	*Rate of Increase (%)*	*Cc./Kg.*	*Rate of Increase (%)*
Ringer's solution	C.P.V.	31.3	32.0	2.2	26.6	15.0
	C.B.V.	44.8	44.6	4.4	36.6	18.9
	C.Z.V.	13.5	12.6	6.6	9.7	28.1
	E.F.	331			346	4.3
5% Glucose dextrose	C.P.V.	35.3	37.4	5.9	31.1	11.8
	C.B.V.	54:6	55.1	0.9	43.5	20.3
	C.Z.V.	19.3	17.7	8.2	12.4	35.4
	E.F.	344			350	1.7
Alginate saline solution	C.P.V.	38.3	41.9	9.3	36.4	4.9
	C.B.V.	58.7	60.1	2.3	49.8	15.1
	C.Z.V.	19.3	17.8	7.7	16.7	13.4
	E.F.	352			356	1.1
Glyco-Algin	C.P.V.	35.1	39.1	11.3	34.6	1.3
	C.B.V.	54.2	59.6	9.9	51.0	5.2
	C.Z.V.	18.7	20.1	7.5	16.4	13.4
	E.F.	344			340	0.5

solution was tested by the Evans-Blue and Crandoll-Anderson methods.

The results are listed in the accompanying table and illustrated in Figure 4.

In the case of Ringer's solution, the circulating blood volume and especially the circulating plasma volume showed a marked decrease twenty minutes after the transfusion.

The reactions produced by dextrose were more or less the same. In my opin-

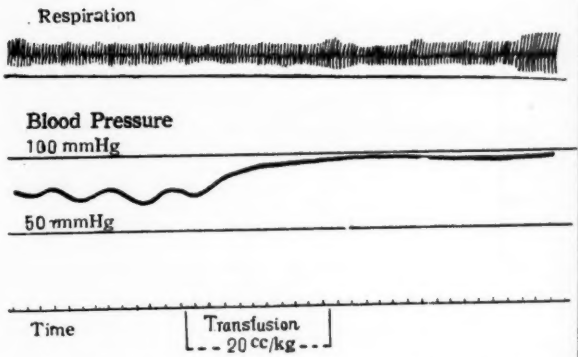

Fig. 3.—Effects of rapid intravenous transfusion.

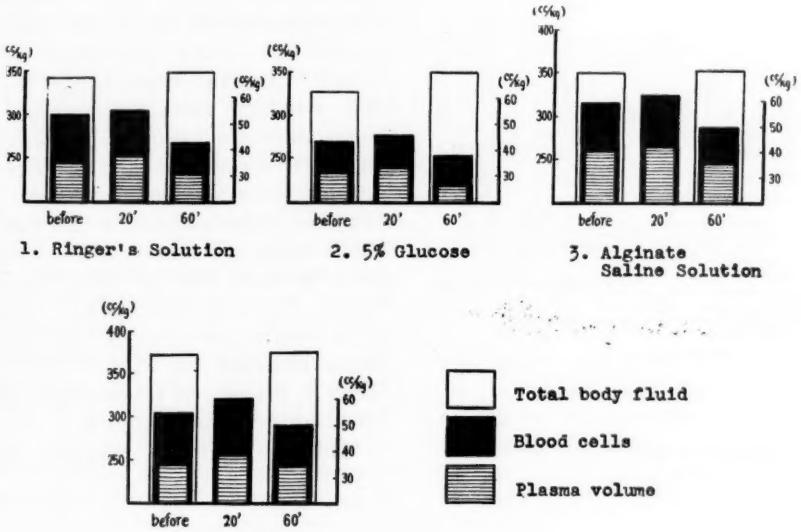

Fig. 4.—Effects on circulating blood and plasma volume.

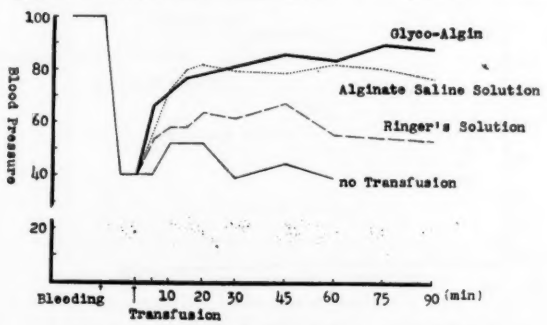

Fig. 5.—Effects of slow (drop) transfusion.

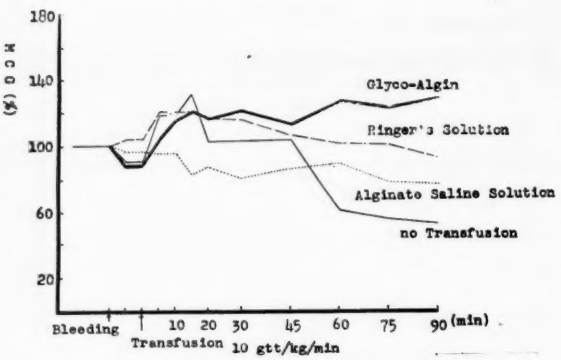

Fig. 6.—Results of myocardiographic study.

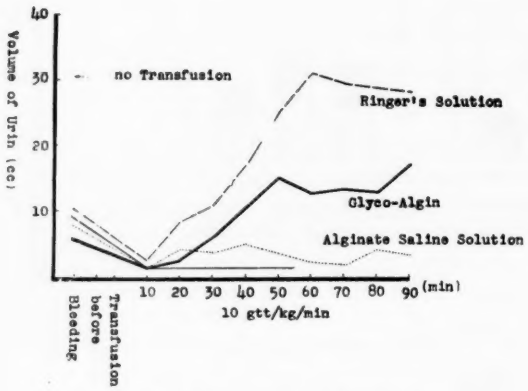

Fig. 7.—Effects on urine clearance.

ion, therefore, this solution is also, in some sense, harmful to the living body. In contradistinction to all the others, with Glyco-Algin an almost normal balance of body fluids is maintained. In other words, it can be said that if Glyco-Algin is used, the deficiencies of body fluids induced by bleeding are restored and adjusted almost to an ideal point.

The results of rapid intravenous transfusion have been described. Experiments with slow (drop) transfusion were next conducted and the results compared with those of rapid transfusion. Solutions were administered at the rate of 10 drops per kilogram of body weight per minute. The results are shown in Figure 5. It was clearly revealed that Ringer's solution does not and cannot raise the lowered blood pressure induced by bleeding. It was further revealed that, in order to raise and maintain the blood pressure, continuous slow transfusion of a solution such as Glyco-Algin is necessary. It should, however, be noted that extremely rapid transfusion (e. g., 40 minims per kilogram of body weight per minute) induces a fall in blood pressure as with other solutions. Even in the case of Glyco-Algin the rise in blood pressure is inhibited.

These experiments suggest important

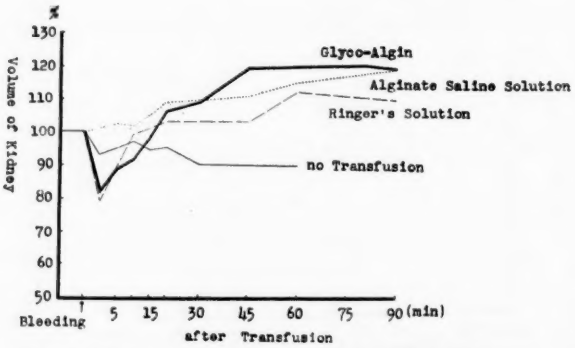

Fig. 8.—Enlargement of kidney with slow transfusion.

factors that may influence the problem of limitation of rapid transfusion.

These results were also verified by myocardiographic studies. While rapid transfusion adversely influenced the width of the myocardiogram, slow transfusion of 10 minims (Fig. 6) of Glyco-Algin, ninety minutes after bleeding, resulted in readings one and three-tenths as wide as those taken prior to bleeding, indicating efficient contraction of the heart.

The influence of Glyco-Algin transfusion on renal function is as follows:

1. Though the value for urine clearance increased gradually after transfusion of Glyco-Algin and returned to normal after twenty-four hours, the variation was within the normal physiologic range; hence it may be concluded that Glyco-Algin has no adverse influence on the kidney.

2. Though the output of urine decreases temporarily after bleeding, it gradually increases as transfusion is started slowly (10 minims; see Fig. 7) and is restored to normal after thirty minutes. In addition, a further increase was observed parallel with the transfusion of Glyco-Algin. When rapid transfusion was administered with alginate saline solution, anuria occurred after sixty minutes. Both Glyco-Algin and Ringer's solution tended to reduce the amount of urine, although a temporary increase was observed in the early stages.

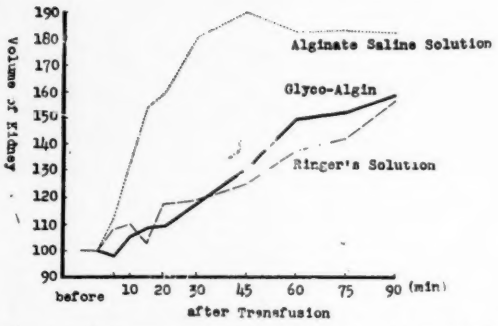

Fig. 9.—Enlargement of kidney with rapid transfusion.

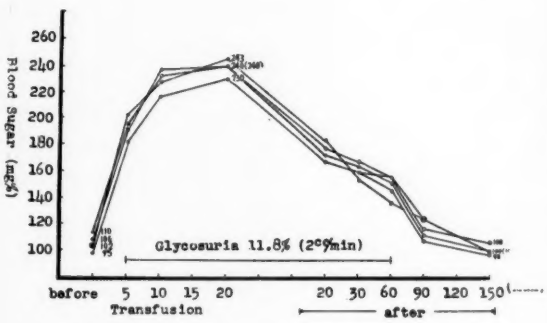

Fig. 10.—Effects on blood sugar level.

3. As to enlargement of the kidney, this was noted in all cases of transfusion. In the case of slow transfusion (10 minims) of Glyco-Algin a 10 to 20 per cent increase

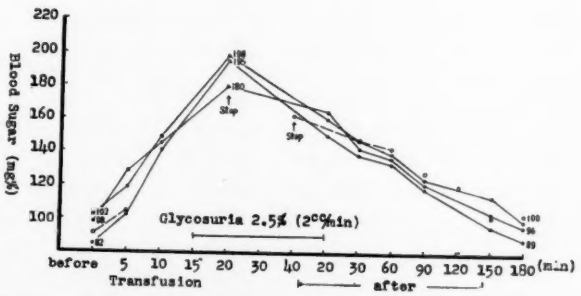

Fig. 11.—Comparative effects of Glyco-Algin and other transfusion fluids on blood sugar level in slow and rapid transfusion.

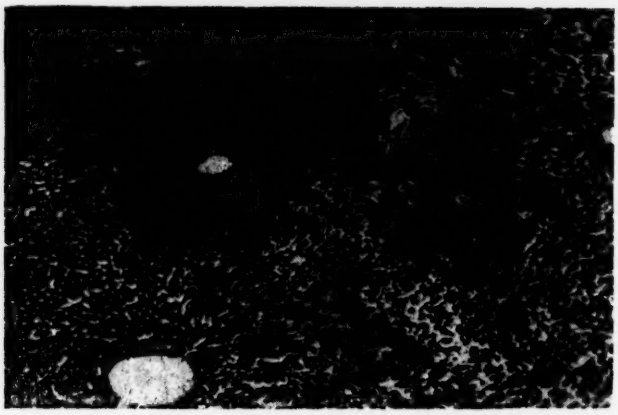

Fig. 12.—Effects on hepatic glycogen (Glyco-Algin).

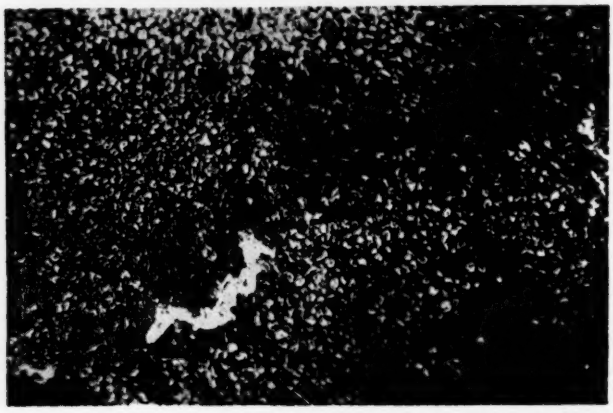

Fig. 13.—Effects on hepatic glycogen (alginate saline solution).

in volume was produced, almost the same as with the other solution (Fig. 8).

In rapid transfusion, however, the results were unfavorable (Fig. 9), especially in the case of alginate saline solution.

It might be necessary, therefore, to add that even with Glyco-Algin a too rapid transfusion may cause undesirable reactions. So I have to say that the limit of speed of transfusion of a polysaccharide such as Glyco-Algin is 10 minims per minute per kilogram of body weight. This limit, however, is equivalent to 600 cc. per minute in adults, so it is entirely negligible in clinical cases. This has been never said of the use of Dextran, etc.

Experiments were conducted to verify the extent of influence of transfusion on the sugar content of the blood, to determine the utilization of dextrose in the body and to determine whether or not the non-utilized glucose surplus dextrose is expelled into the urine.

1. When 2 cc. of dextrose solution per kilogram of body weight per minute was transfused (Fig. 10), the blood sugar content showed a remarkable increase and 11.8 per cent of the transfused dextrose

was expelled into the urine. In contrast, when 1 cc. per minute was transfused, hyperglycemia was minimized and the occurrence of glycosuria was rare.

2. When Glyco-Algin was used in rapid transfusions the blood sugar content was slighter than with dextrose transfusion (Fig. 11), and the amount of dextrose expelled was only 2.5 per cent of the transfused amount, which is but one-fifth of the former figure. With slow transfusion of Glyco-Algin, no dextrose was observed in the urine.

As Dewes pointed out, it is well known that operations cause hyperglycemia accompanied by glycosuria. Since transfusions are frequently administered with operations, I have made observations on the combined influences of operation and transfusion on carbohydrate metabolism.

In the operative experiments rabbits were used. In Group 1 bleeding was induced; in Groups 2 and 3 the stomach and small intestine were crushed; then transfusions were given to the three groups and the results compared.

With dextrose transfusions 50 per cent or more of the transfused amount was expelled; with Glyco-Algin only two-thirds was expelled and the increase in blood sugar was negligible as compared with that following transfusions of dextrose solution. In spite of the fact that Glyco-Algin is a solution of sodium alginate and 5 per cent dextrose solution, it provides more desirable effects and is utilized to a fuller

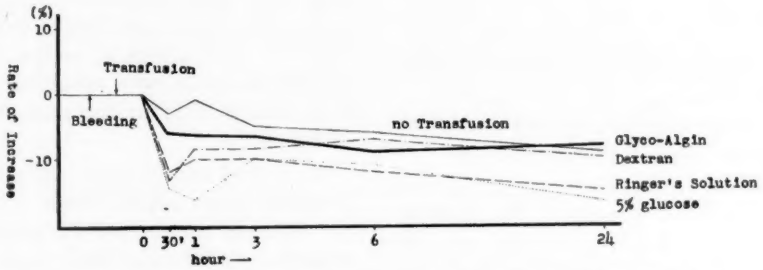

Fig. 14.—Effects of various supplementary fluids on hemoglobin content of blood.

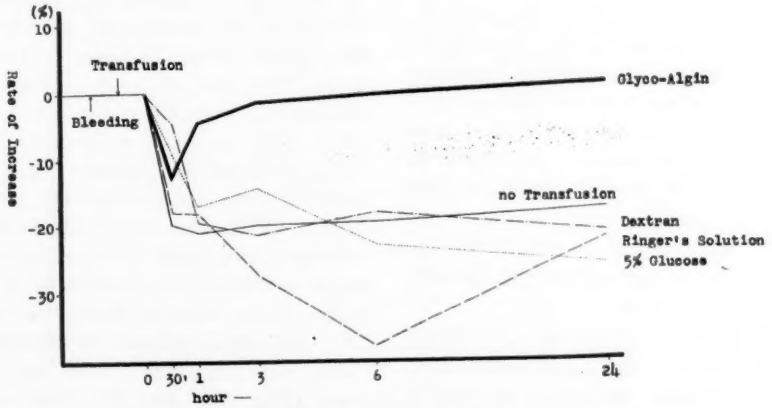

Fig. 15.—Effects on total hemoglobin volume of blood.

extent by the living body than is a simple dextrose solution. This fact has been verified clinically, with highly satisfactory results.

Histologic Picture. — The effect of Glyco-Algin on the main body organs was studied, with special reference to the following points: Will a large volume of Glyco-Algin cause pulmonary edema? Is there any danger of its blocking renal function? Is there a possibility that Glyco-Algin will cause damage to hepatic glycogen or lipoid metabolism? Will damage be caused to the hepatic parenchyma itself?

Glyco-Algin was administered to adult rabbits at the rate of 10 cc. per kilogram of body weight per four or five minutes through the otic veins. The same amount was administered three hours and twelve hours later. This was continued for seven days, and after a lapse of twenty-four hours the rabbits were killed. The lungs, liver and kidneys were removed and examined histologically.

In the control group, Ringer's solution and alginate saline solution was used.

1. *Lungs*: Only a slight expansion was noted in the blood vessels of the alveolar wall in the Glyco-Algin group and in a few of the control groups. In the stomach tissue only slight parenchymatic edema was noted.

2. *Kidneys*: Although a negligible thickening of the cortex in the Glyco-Algin groups and some of the controls, together with slight granulation of protoplasm and slight blurring of nuclear structure, was noted, nothing remarkable was noted in either the medulla or the cortex of the control.

3. *Liver*: Except for an occasional instance of arterial congestion, no notable observations were made.

With Ringer's solution, on the other hand, thirty minutes after administration, the hepatic lobular structure showed a foamlike transformation, causing the structure to lose its clarity. In addition, there was a slight shrinkage of protoplasm, followed by a slight blurring of its structure.

Next, the effects of Glyco-Algin on liver glycogen was studied by Hotchkiss's dye method. Three hours after administration only a negligible decrease in liver glycogen was noted (Fig. 12). In the case of alginate saline solution, however, the decrease of liver glycogen was remarkable, and only a very small number of granules were to be seen in the vicinity of the hepatic lobules. The results with Ringer's solution were between those observed with Glyco-Algin and alginate saline solution (Fig. 13).

In studying the effect on hepatic lipoids, it was noted that only a slight increase was seen after administration of Glyco-Algin, whereas in the case of both Ringer's solution and alginate saline solution a notable increase was observed. This was most remarkable in the star-shaped cells of the liver.

As a final experiment, comparisons with Dextran were made. Dogs were bled at the rate of 20 cc. per kilogram of body weight per minute, and various supplementary fluids were administered in equal volumes. The results are shown in Fig. 14. Though in outward appearance the influence of all transfused solutions on the hemoglobin count in blood was almost the same (Fig. 14), with Glyco-Algin the total hemoglobin volume of the blood increased with time and in approximately three hours returned to normal (Fig. 15). Moreover, this state continued for twenty-four hours. With the other three fluids, the hemoglobin volume does not increase. The same results were prominent in observations of the total erythrocyte count (Fig. 16), the total volume of plasma protein (Fig. 17), the total circulating blood volume (Fig. 18) and the total circulating plasma volume (Fig. 19).

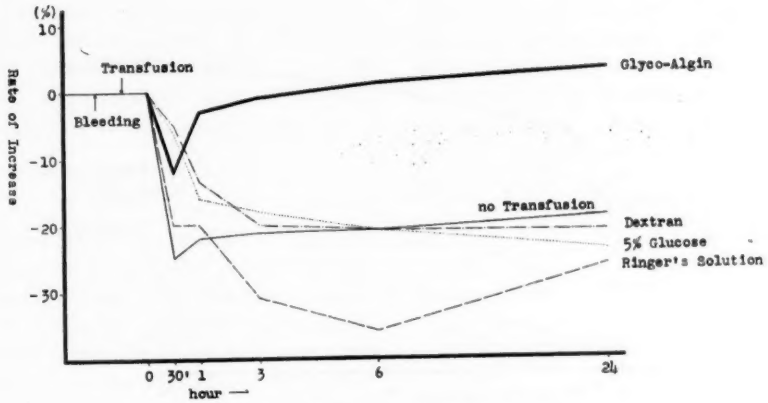

Fig. 16.—Effects on erythrocyte count.

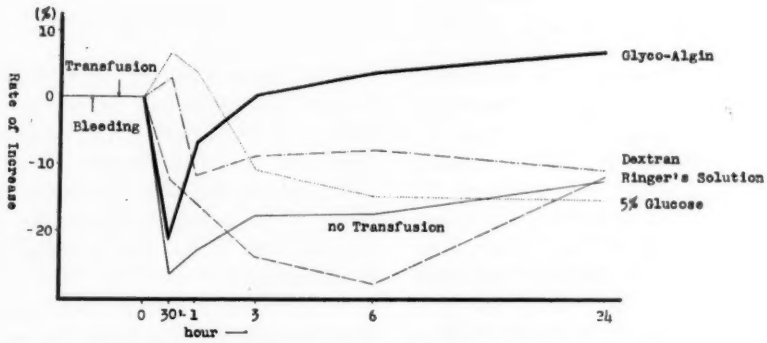

Fig. 17.—Effects on total protein content of blood plasma.

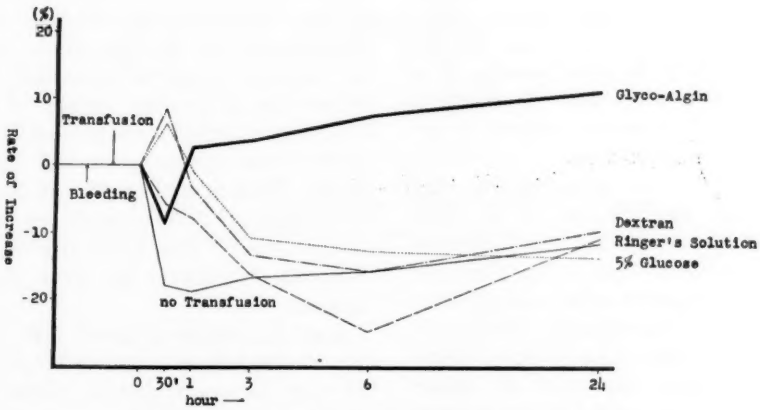

Fig. 18.—Effects on total circulating blood volume.

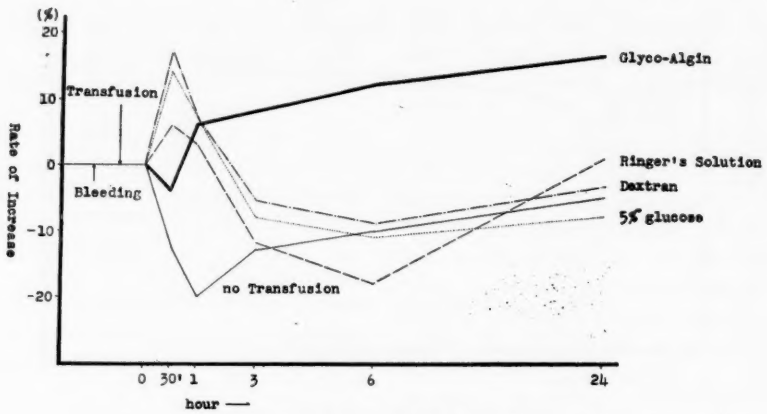

Fig. 19.—Effects on total circulating plasma volume.

In the case of Dextran and dextrose, immediately after transfusion a temporary rise of blood and plasma volume was observed (Figs. 18 and 19). After a lapse of three hours, however, the increase diminishes and the volume reverts to a state similar to that of a subject not undergoing transfusion. These are entirely the same as the results observed by Bloom, who presented that only Dextran of larger molecular weight of 91,700 or more maintained the plasma volume for six hours. That polysaccharides of high molecular weight (over 20,000) have an undesirable influence on the living body, however, has already been verified. In other words, it is evident that Glyco-Algin alone is effective and almost ideal in every respect as an expander of plasma volume.

Next, according to experiments conducted to study the influence of the four fluids on the adrenal cortex, the following facts were revealed: With Glyco-Algin an increase of sudanophilic substance appears earlier and more remarkably than with the other fluids. The ketosteroid enlargement occurs earlier than with the other three fluids, and the return to the normal state is accomplished within twelve hours.

The regressive transformation of the nuclei was observed to begin after six hours. With Dextran similar results were observed but the degree of ketosteroid enlargement was slightly lower. With Ringer's solution and dextrose the return to the normal state was delayed and was much weaker.

In addition, it was proved beyond doubt that transfusion of a large amount of Dextran lengthens the so-called prothrombin time. The same results were presented by Adelson and Ebert at the Sixth Congress of the International Society of Blood Transfusion in Boston, Sept. 3-5, 1956. Dr. Adelson remarked especially that the higher the molecular weight of Dextran the more marked the hemostatic defect, prothrombin consumption and thrombocytemia. That even Dextran of the molecular weight of 20,000 produced the hemostatic defect. The anaphylactic effect of Dextran, moreover, has been verified by Koster.

I am in receipt of about 300 reports on the use of Glyco-Algin in large hospitals all over Japan, including university hospitals, and it gives me great pleasure to say that all reports confirm my opinion

that Glyco-Algin is invariably satisfactory, without one exception. It is also inexpensive. In my surgical clinic alone, 15 to 20 liters, equivalent to 30 or 40 bottles, of Glyco-Algin are used every day.

RÉSUMÉ

La "glyco-algine" est sous tous rapports une solution de transfusion quasi idéale: elle augmente et équilibre de façon satisfaisante la pression sanguine, elle reconstitue et maintient le volume circulatoire du sang et du plasma, et stabilise le volume des urineset le métabolisme des hydrates de carbone.

ZUSAMMENFASSUNG

Das Glyco-algin ist eine in jeder Hinsicht ideale Transfusionslösung, da es zu einer ausreichenden Erhöhung des Blutdruckes führt, den Blutdruck auf gleicher Höhe erhält, das Volumen des zirkulierenden Blutes und Plasmas wiederherstellt und erhält und die Urinausscheidung und den Kohlehydratstoffwechsel stabilisiert.

RESUMEN

Glyco-Algin es, desde todo punto de vista, una solución para transfusiones casi ideal, ya que aumenta y mantiene la presión arterial satisfactoriamente; restaura y mantiene el volumen circulante de sangre y plasma y estabiliza el volumen de orina y el metabolismo de los carbohidratos.

RIASSUNTO

Sotto ogni punto di vista la Glicoalgina è la migliore soluzione per infusioni in quanto aumenta e mantiene in maniera soddisfacente la pressione del sangue, ripristina e mantiene il volume del sangue circolante e del plasma, e stabilizza il volume di urina e il metabolismo dei carboidrati.

SUMARIO

O "Glyco-Algin" é, em todos os aspectos, um soluto quase ideal para transfusão, porque aumenta e mantem satisfatóriamente a pressão sanguinea, restaura e mantem o volume sanguineo círculante, o plasma e establliza o volume urinário assim como o metabolismo dos carbohidratos.

There is a strength of body that comes from strength of soul, and this is genuine. There is a strength of soul that comes from strength of body, and this is spurious.

—*Zangwill*

The Development of Operations for Hypospadias

Cure by Means of a Pedicled Graft from the Urinary Bladder

PAUL ROSENSTEIN, M.D.

SAO PAULO, BRAZIL

HYPOSPADIAS is a deformity brought about by deficient development of the urethra. As a result of this defective urethral formation persisting from the fetal period five different deformities of the external male genital apparatus may result:

1. The mouth of the urethra may open into the lower part of the glans, into the sulcus coronarius (hypospadias glandis).

2. It may open into the region of the pars pendulla of the penis (hypospadias of the penis).

3. It may open at the borderline between the penis and the scrotum (hypospadias peniscrotalis), where the genital folds of the sinus urogenitalis have failed to join.

4. It may open into the perineum in cases in which the genital furros failed to close completely (hypospadias perinealis).

5. Forms of pseudohermaphroditism may occur, which may create an erroneous impression because of the fact that, in cases of hypospadias, peniscrotalis and perinealis, the scrotum is also split to a varying extent.

The simplest form of deformity is the opening of the urethra into the lower part of the glans. Bouisson, in 1860, was the first to attempt correction of this deformity, severing the scar tract existing in the region of the lower surface of the glans. Duplay severed the subglandular tissue transversely and sutured the incision lengthwise. This procedure was conducive to success in cases involving few complications. Dodson divided Buck's fascia by a transverse cut, including all constricting fibers of the intravenous septum; the incision is sutured longitudinally. Poussen has stated that the severance of tissues at the foot of the penis is, not in itself, capable of eliminating the deformity of the glans. It would therefore be necessary to separate the glans from "both cylindrical caverns" through an incision, in order to free the penis entirely from its pathologic upward position. Bucknall, too, made a transverse incision in the first-stage procedure. Thompson-Walker made a circular incision around the external meatus, leaving a collar of skin around the opening, and prolonged the incision laterally on each side, so that it extended to one-third of the entire circumference of the organ. A longitudinal medial incision is made from this on the ventral surface of the penis for two-thirds of its length, to allow the necessary elongation. The

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method often used earlier, i.e., "pulling the urethra" through a canal made in the glans, with a pointed scalpel, originated with Thompson-Walker. Today hypospadias glandis can be cured by the creation of a new urethra. All operations aiming at correction of the original urethra by pull-through or relocation are obsolete, because no improvement is thereby made in the deformity of the penis.

A brief summary of the development of the hypospadias therapy and a description of a new method of operation, in which the urethra is replaced by means of transplantation of the mucous membrane of the bladder.

History.—Nove-Josserand, in 1897, used scrotal grafts for replacement of the deficient urethra. He used Thiersch graft lobes, which he transplanted into a canal of the pars pendula prepared in advance. About 1900, surgery made sensational progress in the field of tissue plastics. What was virtually a race, aiming at the best substitute for the deficient urethra, began at once. Creevy stated that scrotal skin was unsuitable for making a urethra, since hair grows into it; forming stones. Edmund then used skin from the prepuce, with success. Nesbit and also Davis used the skin from the dorsum of the penis, which they transplanted to the ventral surface. Some surgeons used skin from the penis as well as from the scrotum. Many satisfactory results were obtained, since the skin in this region is hairless, pliant and elastic. The use of pedicled skin grafts from the surrounding skin was attempted, but this was soon given up, since the skin of the prepuce was more easily available. Russell formed a tunnel of the skin of the prepuce and later pulled the glans through.

Free transplantations, which at one time were performed frequently, have been dropped altogether. A great many experiments have been made to transplant entire cavernous organs, such as the appendix, the ovarian tubes, or a vein; skin also has been used for making a new urethra, as well as Thiersch's lobes and the vagina. Good initial results were obtained with all this material, but this kind of transplant was absorbed and replaced with scar tissue. Masson used Thiersch's lobes with some success but encountered many failures due to disruption of the transplant by coagulated blood. Schieden, in 1919, was the first to use the urethra from another human being. Lexer, in 1911, made use of the appendix. In 1910, Tanton attempted to use a vein for transplantation and Legueu experimented with the *mucous membrane of the vagina.* He succeeded in making a canal but abandoned the method, as the vagina could not be adapted to the constitution of a urethra. All attempts at using extraneous material are doomed to failure since such transplants are biologically intolerable.

The most common operations used at present include:

Hamilton Russell's "stole" operation. This is performed in four stages, in which an incision is made through the frenum that binds down the penis, and the glans is tunneled with a tenotomy knife. Incisions are then made laterally in two lines; a strip of prepuce like a clergyman's stole is thus marked out, and finally the flaps forming the urethra are sutured. Davis uses the skin from the dorsum of the penis and adds the prepuce if needed. Ombredanne's operation is recommended by some surgeons. Bidder incises the ventral aspect of the penis on both sides, forming the urethra from the skin of the penis and the floor from scrotal skin. This operation is adequate for peniscrotal hypospadias. Denis-Browne uses the skin of the penis, which is supposed to possess, among other advantages, the quality of not forming keloids. In addition, he uses the skin of the prepuce. A perineal urethrostomy is

performed to by-pass the urine. The flap covering is provided for by a double folding of the prepuce, through which a hole is made for the passage of the glans. The preputial fold is then sutured to the inferior surface of the penis, which has been denuded by removal of the flap used to form the sac.

Cecil's operation, which is a modification of Bucknall's, has been used by many surgeons with some success. Lowsley and Kirwin make a double flap from the cutaneous surfaces adjoining the abnormal urethral orifice. The flaps are freed, brought up in the penis and arranged to form a sac at the extremity of the glans. Nesbit also employs the dorsal skin of the penis.

Edmund's operation is performed in three stages, spaced at intervals of three months. In the first stage a buttonhole is made in the preputial hood. The second stage consists of straightening the penis; finally, in the third stage, a new urethra is made from the tissues provided by the preputial horns and is covered with lax penile skin.

Modern surgeons have learned that for the success of a plastic operation certain conditions are indispensable. The tissues employed, after being placed in the position required, must not be subjected to any tension whatever. The graft employed must be well fed. This is of particular importance with regard to plastic operations on the urethra, because long grafts are often used and a blood supply for these must be secured with special care. Diversion of the urine is absolutely necessary until the new urethra has been completed. This is not accomplished by means of a catheter through the urethra but through either a cystostomy or a perineal urethrostomy. Postoperative bleeding should be kept at a minimum to prevent destruction of the suture line. The knots of the sutures employed must be tied on the outside of the urethra. The ideal age for plastic operations is from 4 to 10 years, since by that time the tissues have reached a certain degree of stability.

In view of the many and various procedures aforedescribed, a new method was sought for plastic operations on the urethra that would, in view of the type of tissue to be chosen, insure durability. It was important to choose a transplant that would transport urine physiologically. The urinary bladder itself was therefore chosen as the ideal tissue, since the bladder is an extraordinarily resistant organ that expands readily and regains its normal capacity even after strong shrinking. It is therefore possible to cut large pedicle grafts out of the vesical mucous membrane without seriously endangering the organ's function. In addition, the vesical wall is well supplied with blood; therefore, the blood supply to the pedicled graft is also insured.

REPORT OF CASES

CASE 1.—E. K., a boy 7 years of age, complained of dysuria, dribbling, incontinence and pronounced pyuria. Examination revealed multiple fistulous openings on the penis and scrotal hypospadias. The fistulas were due to earlier attempts to repair the hypospadias by surgical correction. The penis was edematous at the end and slightly rolled downward. Urination was frequent. When urinating, the boy stood up and strained, putting his hands on his abdomen and crying, and that the urine emerged from the various fistulous openings like water out of a garden sprinkler. Roentgenograms of the vertebrae revealed no abnormality. The remainder of the physical examination also gave normal results.

Operative Technic.—All lobulous residual tissue on the penile shaft remaining from the previous operations was radically eliminated and a homogeneous new wound created. The urethra itself was cut. The bladder was then prepared and the peritoneum reflected from it. A square pedicled flap was cut out of the bladder, which could be folded down to the penis (Fig. 1*B*). The penis was then turned up and the graft sewed completely on to the

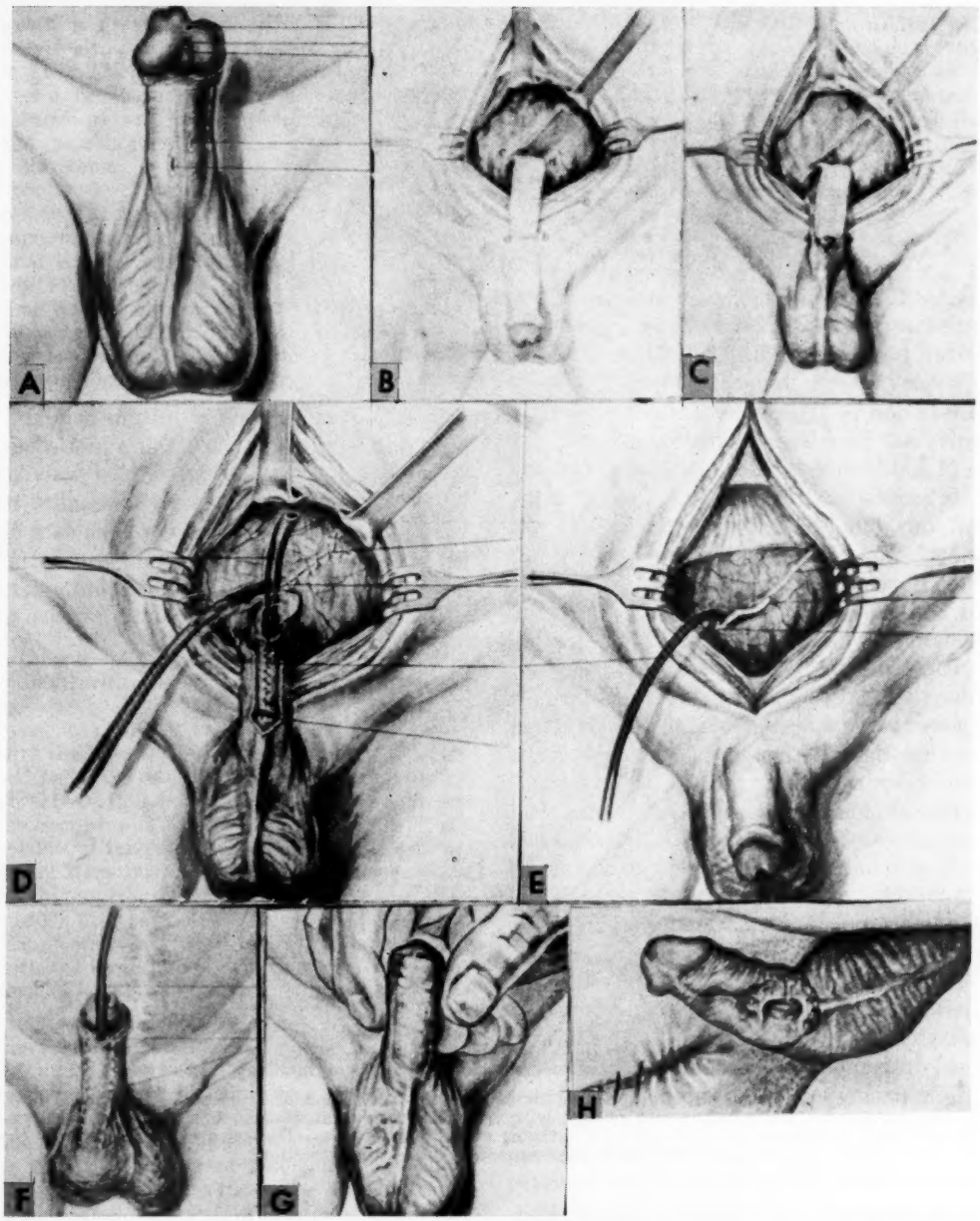

Fig. 1.—*A* to *H* inclusive, Case 1. Appearance of hypospadias and fistulas in boy aged 7. *B*, bladder prepared; pedicled flap folded down to penis. *C*, penis turned upward; graft sewn onto defect. *D*, graft formed into tube around rubber drain and duly sewn. *E*, graft cut off, leaving only catheter in bladder; penis turned downward. *F*, penis turned upward for demonstration. New urethra covered by graft taken from scrotum. *G*, hypospadias cured. *H* (Case 2) walnut-sized hypospadias in an adult; scar from high section; many scars around the hypospadias.

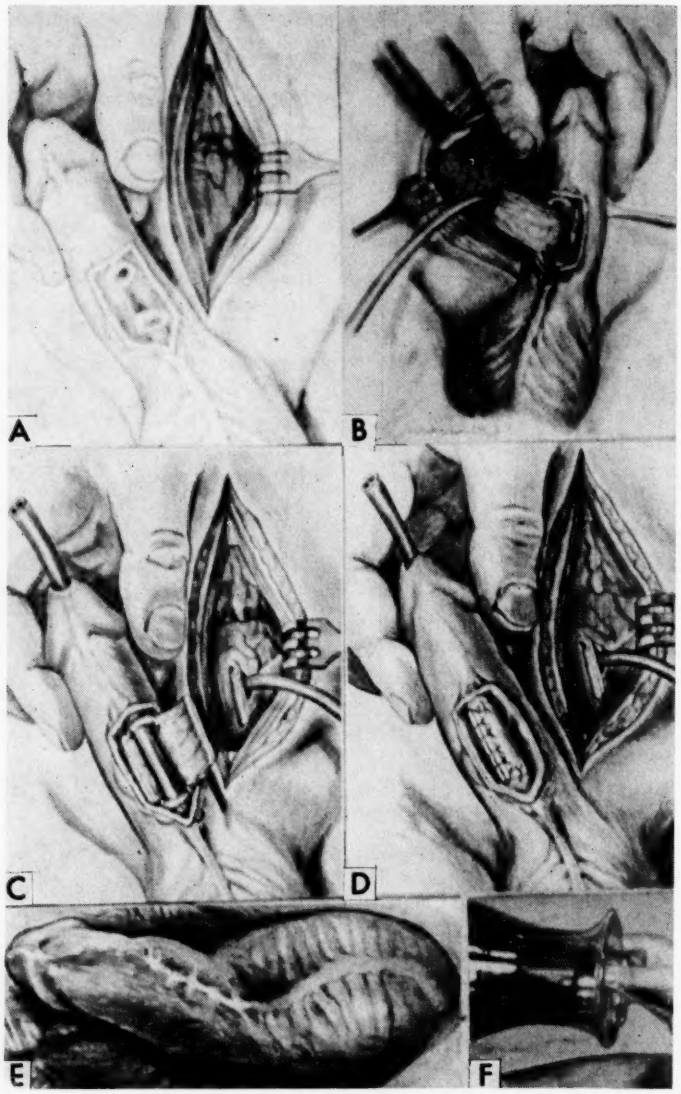

Fig. 2 (Case 2).—*A*, excision of all scarred tissue and urethra. Bladder is opened. *B*, pedicled flap of bladder formed and brought into contact with intersected urethra. Bladder is closed up to opening for catheter. *C*, pedicle of bladder is out; catheter remains in bladder. *D*, new urethra is formed. *E*, penis healed. *F*, demonstration of urethral function.

defect (Fig. 1*C*). (This must be done without tension.) The graft was next formed into a tube around a rubber drain and duly sutured (Fig. 1*D*). The pedicle of the graft remained in connection with the bladder. The bladder was closed except for the medial opening, into which a catheter was inserted. Ten days later the well-fed graft was cut off, leaving only the catheter in the bladder. Figure 1*E* shows the wound wide open, but in reality the wound was sewed up neatly and snugly around the catheter. When a single tube had been formed

from the former urethra and the new vesical graft, a graft was taken from the scrotum to cover the new urethra and was sewed onto it. (Fig. 1*E*). When the bladder healed, it was necessary to put a catheter into the newly formed urethra. As a result of this, urethritis and pain occurred; it was obvious that the child could not tolerate a catheter, so a "boutonniere" was created and the catheter removed from the urethra. Through this passage undisturbed healing occurred and the final result was satisfactory (Fig. 1*G*). The boy has been under observation for a long time and urinates in a good stream without difficulty. Dilation of the urethra was performed without difficulty, and no stenosis or stricture has occurred in seven years.

It was my impression at first that this operation was suitable only for children, in view of the fact that changing states of fullness of the corpora cavernosa would disturb such a plastic procedure. Successful results, however, have been obtained in 2 adult patients. The case of 1 of these is here reported.

CASE 2.—A 34-year-old man was admitted to hospital with a history of gonorrhea ten years earlier, followed by prostatic abscess that ruptured into the rectum during an examination with the patient under anesthesia. Both urine and feces had been diverted from their natural passages. In addition to the fistula between the rectum and the bladder, there was hypospadias of the pars pendulla of the penis (Fig. 2*A*). Many operations had been done to close the hypospadias, but without success, so that when I first saw the patient the whole penile section was transformed into thick scar tissue, with the large hypospadic opening of the urethra (Fig. 2*B*).

Operative Technic.—The rectovesical fistula was first repaired by cutting circularly around the anus, the incision penetrating in all directions into the periprocytic tissue. The rectum was freed and the sphincter isolated. The rectum was brought out through the anus, so that the old scarred fistula in the rectum was placed exterior to the anus. The sphincter was sutured carefully around the rectum and the exteriorized portion cut off. (This was a modification of the Rochenegg operation.) A catheter was introduced into the bladder, and in about four weeks the rectum was completely healed. The hypospadias operation was then performed in the manner described (Fig. 2, *C* and *D*). The patient was followed for eight years and has had no trouble with urination or with rectal complaints since the last operation. When he was last examined erection and ejaculation were normal, the urine was clear, urination with a good stream was habitual (Fig. 2, *E* and *F*). Periodic dilation was done after the operation.

COMMENT

The mucous membrane of the bladder has been used as a transplant in the cure of hypospadias because of the good nutrition of the graft and its physiologic ability to conduct urine. It is not necessary, in this operation, to divert the urine through a perineal urethrostomy, but it is done through a cystostomy, which also has the advantage that the material for the graft is immediately at hand. There is no other organ so rich in mucous membrane, so elastic and so much inclined to heal easily as the bladder. Modern methods of operation take this quality into consideration. It is possible to extirpate much of the bladder and find, a few weeks later, that the walnut-sized remainder has become once more an organ of almost normal capacity. One should not hesitate, therefore, to cut large grafts from the anterior wall in order to obtain surplus material for a plastic operation. Although it is true the tubular graft material does not usually shrink—which is quite a contrast to what occurs with a free transplant—it is a good thing to suture without tension and to build the tube without a drain. The mucous membrane of the urethra and bladder will easily heal per primam, in view of the fact that they are cognate mucous membranes and do not have to perform any function that is new to them.

The nutrition of the graft is ample, so that there is no danger of necrosis. Severe purulent cystitis is a contraindication to this procedure, but mild cystitis or mild edema of the mucous membrane need not

prevent its use.

SUMMARY

After commenting on the various usual operations for hypospadias, the author suggests a new physiologic method, based on the use of a transplant of mucous membrane from the bladder, which by nature is intended to transport urine. Two cases are reported: that of a 7-year-old boy with fistulous hypospadias and that of an adult who had undergone numerous earlier operations without success. The author is particularly convinced that this method will guarantee success, since it is physiologic. Many of the other methods thus far used have the disadvantage of using tissues for the transportation of urine that have to adapt themselves to this action. This has often proved impossible.

RÉSUMÉ

Après avoir commenté les diverses opérations usuelles pour hypospadias, l'auteur suggère une nouvelle méthode physiologique basée sur l'utilisation de la muqueuse de la vessie qui est faite pour le passage de l'urine, en tant que greffe. Il rapporte deux cas: celui d'un garçon de 7 ans présentant un hypospadias scrotal fistuleux, et celui d'un adulte ayant déjà subi sans résultat de nombreuses opérations. Dans les deux cas l'auteur est convaincu du succès de sa méthode, car elle est physiologique. Un grand nombre d'autres méthodes ont le désavantage d'utiliser des tissus qui doivent s'adapter au passage de l'urine, ce qui s'est souvent révélé impossible.

ZUSAMMENFASSUNG

Nach einer Besprechung der verschiedenen üblichen Operationen zur Behandlung der Hypospadie schlägt der Verfasser eine neues physiologisches Verfahren vor. Es beruht auf der Verwendung von Blasenschleimhaut als Transplantat, deren natürliche Funktion in der Fortleitung des Harnes liegt. Der Verfasser berichtet über zwei Fälle. Der eine betrifft einen siebenjährigen Knaben mit einer fistelförmigen Hypospadie des Hodensacks, der andere einen Erwachsenen, an dem zahlreiche Operationen ohne Erfolg ausgeführt worden waren. Der Verfasser ist überzeugt, dass sein Verfahren, da es physiologisch ist, in beiden Fällen zum Erfolg führen muss. Viele andere Methoden leiden unter dem Nachteil, dass sie Gewebsarten benützen, die sich der Aufgabe der Harnfortleitung erst anpassen müssen, was sich oft als unmöglich herausgestellt hat.

RIASSUNTO

Dopo aver dissertato sui varii metodo di operazioni usate nella ipospadia l'autore suggerisce un nuovo metodo fisiologico che si basa sull'uso di mucosa presa dalla vescica, in funzione di trapianto. Egli riporta due casi: quello di un bambino di 7 anni che aveva una ipospadia scrotale e quello di un adulto che si era sottoposto a numerosi interventi chirurgici senza trarne alcun vantaggio. In entrambi i casi l'autore si dichiara convinto che il suo metodo potrebbe avere successo data che è un metodo fisiologico. Gli altri metodi, infatti, hanno lo svantaggio di usare tessuti che devono essi stessi adattarsi al trasporto di urina, il chè si è spesso dimostrato impossibile.

RESUMEN

Después de comentar las varias operaciones usadas para hipospadias, el autor sugiere un nuevo método fisiológico, basado en el uso de mucosa de la vejiga como trasplante, el cual por naturaleza esta hecho para transportar orina. El se refiere a 2 casos: el de un niño de 7 años que tenía un hipospadias escrotal fistuloso y el de un adulto que se había sometido a numero-

sas operaciones sin éxito. En ambos casos el autor está particularmente convencido de que su método garantizaría el éxito, ya que es fisiológico. Muchos otros métodos tienen la desventaja de emplear tejidos que deben adaptarse al transporte de orina, lo cual se ha comprobado imposible frecuentemente.

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The longer I live the more it pains me to see man, who occupies his supreme place for the very purpose of obtaining a command over nature and freeing himself and his fellow-creatures from the violent force of necessity,—to see him, influenced by some preconceived and false notion, doing just the opposite of that which he wants to do; and then, because his whole design has been marred, bungling miserably over everything.

—Goethe

Neurologic Surgery

Intracranial Aneurysms, Congenital and Acquired: Diagnosis, Treatment and Prognosis

EDGAR N. WEAVER, M.D., F.A.C.S., F.I.C.S.

ROANOKE, VIRGINIA

WITHIN the past fifteen years the medical profession has placed increasing emphasis on intracranial aneurysms. A spontaneous subarachnoid hemorrhage is usually suspected on the basis of sudden headache, with or without loss of consciousness, and confirmed by bloody fluid revealed by lumbar puncture. In the majority of cases the bleeding is due to a ruptured intracranial aneurysm. Because of the difficulty in localization of the aneurysms before the development of thorough and safer angiographic methods, however, nothing much could be done from a surgical standpoint; the patients, therefore, were mainly treated conservatively with bed rest and sedation.

In 1927, Egas Moniz[1] in Spain introduced angiography. Fifteen to twenty years ago Jefferson[2] and Dandy[3] were pioneer workers in the field of intracranial aneurysms, but their diagnoses were made mainly from clinical signs, since angiographic examination was more of a procedure then than it is now and was infrequently used. At that time the carotid artery was exposed in the neck, thorotrast or diodrast was injected into the artery, and roentgen films were usually taken in the operating room with a portable machine. This was an unsatisfactory procedure, since the quality of the pictures was usually poor and not of much help in arriving at a diagnosis. In addition, there was a relatively high incidence of mortality and morbidity from the procedure itself. Within recent years, however, percutaneous arteriographic study of the carotid and vertebral system has become a relatively safe and a more satisfactory procedure. Until the past year the dye of choice was usually 35 per cent diodrast or 30 per cent urokon. At present, 50 per cent hypaque (sodium diacetrozoate) is being used, with fewer toxic effects and sharper contrast on the roentgenographic films. Dunn, Uihlein and Holman[4] have reported on the use of hypaque, 3 to 5 cc. in each injection, with excellent filling. The only complication encountered in the taking of 50 arteriograms took the form of extensive petechial hemorrhages over the face and orbital conjunctiva. This occurred in a patient known to be allergic. The only complication I have encountered thus far in about 30 injections is some blanching of the face on the side that received the injection. Thus, with improved technic and less toxic contrast media,

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many of the complications encountered in the past should be lessened. General anesthesia seems to have definite advantages over local anesthesia with regard to complications.

In 1952, Abbott, Gay, and Goodall[5] reported the complications in 174 cerebral arteriographic precedures. Most of these were of cerebral vascular origin, with temporary or permanent hemiplegia, aphasia, hemianopsias, convulsions and even death. Extracranial complications were cervical hematoma necessitating tracheotomy, severe irritation of the soft tissue, with fever and pain, hoarseness, transitory diffuse punctate hemorrhages of the face and neck and radiculitis of the cervical roots (from the taking of a vertebral arteriogram). Horner's syndrome, temporary and permanent, was occasionally encountered. The authors considered the complications due to mechanical factors, vasospastic factors, disturbance of the blood-brain barrier, air or blood clot embolism and sensitivity to drugs. Hypaque has not been used long enough to justify evaluation of the complications it may cause, and the extracranial complications should be essentially the same; the more serious cerebral complications, however, should be encountered less often.

With better angiographic technic aiding in the diagnosis of intracranial aneurysmal lesions, improved surgical methods have necessarily followed. Better surgical technic, careful selection of patients and the time of operation, and hypotensive anesthesia have all helped lower surgical mortality and morbidity rates. As time goes on, experience with the management of these lesions will certainly lead to many more cures.

Saccular intracranial aneurysms may be grouped, according to location, into those of the infraclinoid part of the internal carotid artery, those of the supraclinoid part of the internal carotid artery, those on or about the circle of Willis, those of the peripheral part of the major cerebral vessels and those in the posterior fossa. The arteriovenous malformations will be briefly discussed.

The symptoms and treatment of these saccular aneurysms vary with their various sites and will be discussed according to location.

Infraclinoid Aneurysms of the Internal Carotid Artery.—Infraclinoid aneurysms of the internal carotid artery occur on the cavernous part of the artery. These aneurysms are usually large, saccular lesions, causing symptoms because of compression of the adjacent structures or by rupture into the cavernous sinus, produc-

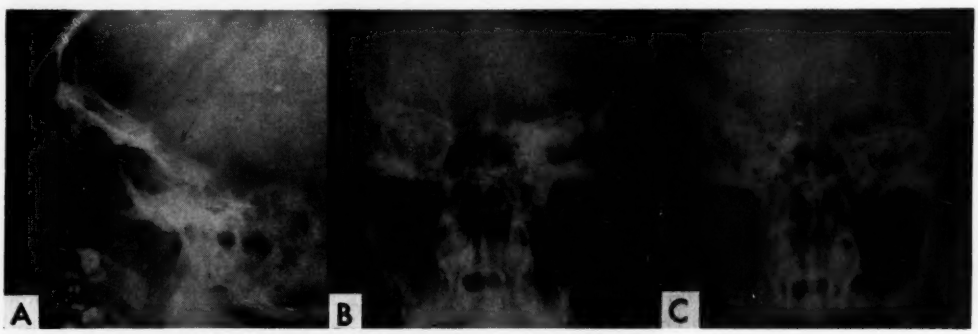

Fig. 1 *(Case 1).—A,* arteriogram showing arteriovenous fistula between intracranial carotid artery and cavernous sinus. (Note large amount of dye in the region of cavernous sinus and dilated ophthalmic vein.) *B,* left carotid arteriogram showing dye in cavernous sinus (lateral view). *C,* normal right cerebral arteriogram of same patient for comparison.

ing an arteriovenous fistula between the carotid artery and the cavernous sinus. About 75 per cent of the arteriovenous lesions are produced by trauma and the remaining 25 per cent by spontaneous rupture.

Sugar,[6] on the basis of work done by Padgett,[7] suggested that aneurysms of this part of the carotid artery, as well as elsewhere in the cerebral vascular system, may be due to weakness of the vessel at the site of an embryonic vessel or possibly an actual nubbin of an incompletely resolved embryonic vessel. The carotid-cavernous sinus fistulas produce pulsating exophthalmos in about 90 per cent of the cases. There are frequently marked injection in the eye, chemosis, extraocular palsies and papilledema. The fifth nerve is involved, particularly the first division, producing pain in the forehead and occasionally facial paralysis. A bruit is usually present, which is an annoying symptom from the patient's point of view. The bruit is best heard by the examiner over a closed eye or in the temporal region. A ruptured infraclinoid aneurysm of the internal carotid artery into the cavernous sinus causes no subarachnoid bleeding unless there is a supraclinoid extension of the aneurysm.

The symptom complex of an unruptured aneurysm of the cavernous sinus is fairly typical, with, primarily, palsy of the third nerve and pain in the distribution of the fifth nerve, particularly the first division and, more rarely, in the second division. Occasionally the pain occurs in all divisions. The fourth and sixth cranial nerves are sometimes involved alone or in association with involvement of the oculomotor nerve. According to Jefferson,[2b] the most commonly encountered is the anterior cavernous syndrome in which the ophthalmic division is involved, with paralysis of the third nerve. In the middle cavernous sinus syndrome there is pain in the distribution of the first and second division of the trigeminal nerve, plus some type of extraocular paralysis. Pain in all three divisions of the trigeminal nerve, plus extraocular palsy, occurs with aneurysms involving the posterior part of the cavernous sinus.

Surgical treatment of an aneurysm of the internal carotid artery of the infraclinoid artery consists of ligation of the artery involved in the neck alone or the combination of this procedure with intracranial application of a clip to the internal carotid artery to trap the aneurysm.

There has been a great deal of variation in the mortality and morbidity rates attributed to cervical carotid ligations. In 1942 Dandy[8] reported 88 cases of cervical ligation, with a mortality rate of only 4.5 per cent and complications in 5.6 per cent. He stressed percutaneous occlusion of the carotid artery in the neck for ten minutes or longer prior to ligation. In 1951 Voris[9] reported a mortality rate of 17 per cent in his series. In 101 carotid ligations, Poppen[10] reported a 3 per cent mortality rate and an 8 per cent incidence of temporary or permanent hemiplegia. Steelman, Hayes, and Rizzoli[11] performed 14 ligations in the neck with no deaths. Bassett, List and Lemmen[12] reported a 3.4 per cent mortality rate for carotid ligations, and 12 of 29 patients (41 per cent) were hemiplegic.

In 1953, Black and German[13] reported a follow-up of 35 patients treated by cervical ligations, the common carotid usually being ligated in patients over 40 years of age. There were no operative deaths. These patients were followed over a sixteen-year period, at the end of which time 27 were living. In the opinion of these authors the strain on an aneurysm is the result of some of the stresses involved, including total hydrostatic pressure, the pulsatile nature of the flow, turbulence and jet action. After ligation they observed a reduction in hy-

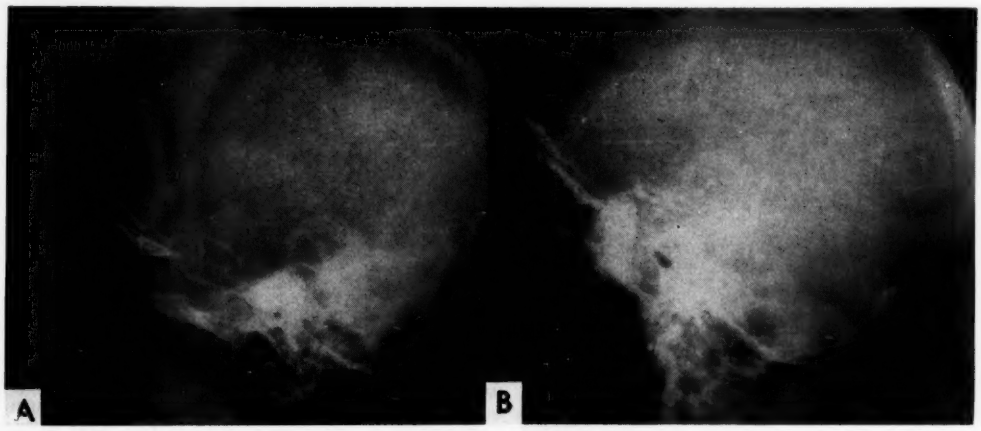

Fig. 2 *(Case 3).—A,* roentgenogram of skull showing erosion of sellar region and abnormal calcification caused by large aneurysm. *B,* large aneurysm of left internal carotid artery.

drostatic pressure and pulsatile action. They concluded that systolic thrust is greatly diminished by ligation and that this accounted for the satisfactory results.

Hamby,[14] in a recent report, stated that he has limited his cervical ligations to infraclinoid aneurysms.

The following 3 cases are representative of aneurysms on the internal carotid artery in the cavernous sinus. In Case 1 a traumatic arteriovenous fistula was treated and cured by ligation of the internal carotid artery. In Case 2 an unruptured aneurysm of the cavernous sinus was present, producing palsy of the third nerve, with pain in the forehead. This aneurysm was treated by ligation of the common carotid artery, with temporary relief of pain for a week. A clip was then applied intracranially on the internal carotid artery with complete relief of pain and palsy of the third nerve. In Case 3 there was an aneurysm of the cavernous sinus that produced pain in the area of the second division of the trigeminal nerve, in addition to long-standing palsy of the sixth nerve. The

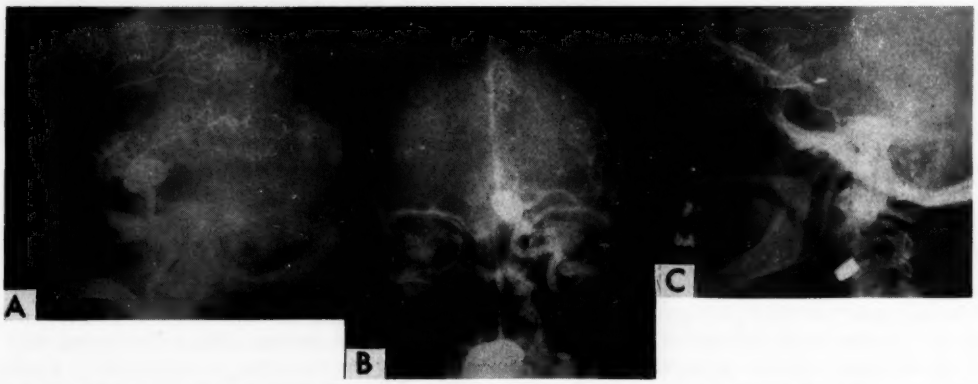

Fig. 3 *(Case 4).—A,* large aneurysm, supraclinoid part of internal carotid artery (lateral view). *B,* anteroposterior view. *C,* postoperative film showing clip on internal carotid in neck and clips on internal carotid intracranially.

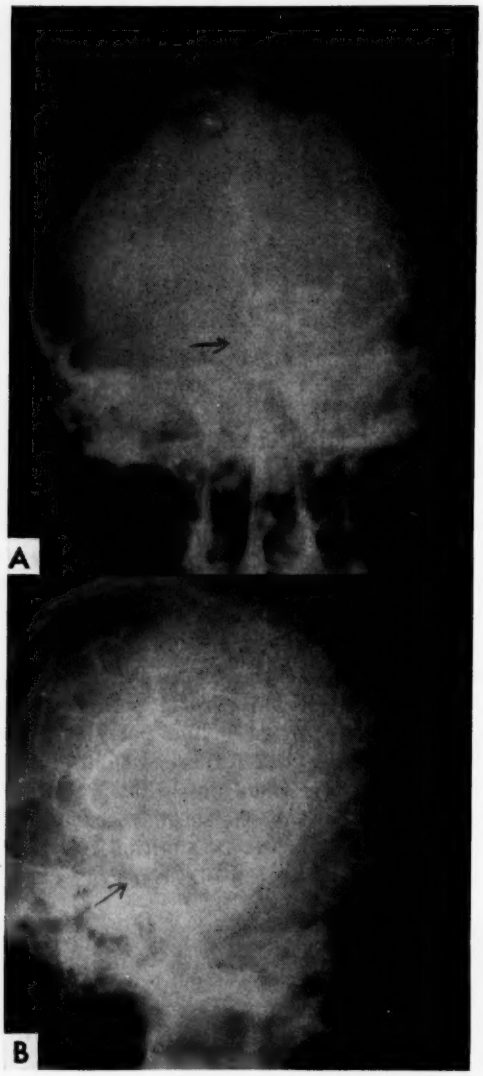

Fig. 4 *(Case 5).*—*A*, left arteriogram showing aneurysm of left anterior cerebral artery. *B*, oblique view.

patient was relieved of her pain by ligation of the common carotid artery, but palsy of the abducens nerve persisted.

CASE 1.—A 45-year-old white man fell and struck his head on a metal bar. He was dazed but not rendered unconscious. Two weeks later he began to notice a "hissing noise in his head," and when examined he had slight exophthalmos, with definite pulsation and injection of the conjunctiva on the left. Roentgenograms of the skull showed no abnormalities, and an arteriogram (Fig. 1, *A*, *B*, and *C*) revealed evidence of an arteriovenous fistula, with most of the dye going from the internal carotid into the cavernous sinus. Ligation of the left internal carotid was followed by absence of all symptoms and signs of the fistula in one week.

CASE 2.—A 51-year-old white man had noticed episodes of transit diplopia for two years and constant left frontal headache for two and one half months. On examination there was evidence of incomplete palsy of the third nerve on the left and hypesthesia to pinprick on the left side of the forehead. Otherwise the results of neurological examination were negative. Roentgenograms of the skull were normal. Percutaneous arteriographic examination was done on the left, and a large aneurysm in the cavernous part of the left internal carotid artery was observed. The left common carotid artery was ligated, with some improvement in the forehead pain for about a week. The pain returned, however, and a left frontal craniotomy was done, with application of a clip to the intracranial internal carotid artery, distal to the aneurysm. Pain was relieved, and the oculomotor palsy cleared. When the patient was last heard from, three years after the operation, he had no symptoms and was working daily.

CASE 3.—A 65-year-old white woman had diplopia, which developed in childhood and had persisted. Five years before her admission to the hospital she had a "cerebral hemorrhage" without residual paralysis. Ten days before her admission, severe pain developed in the left side of the face, with drooping of the left eyelid. Examination also revealed a complete left abducens paralysis.

The patient stated that she had been unable to move the left eye outward for eighteen years. There was pain in the distribution of the first and second division of the fifth nerve on the left, without objective sensory changes. Roentgenograms of the skull (Fig. 2*A*) revealed marked erosion of the sella turcica, with abnormal calcification. Arteriographic study (Fig. 2*B*) revealed a large aneurysm of the left internal carotid artery. The common carotid artery was exposed and ligated three

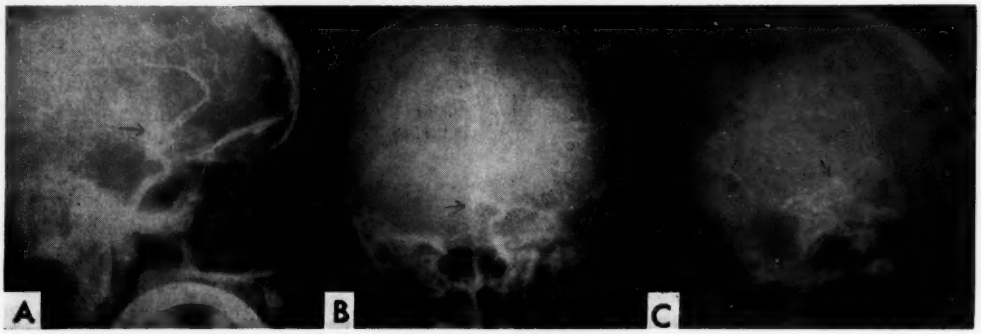

Fig. 5 *(Case 6).—A,* right arteriogram showing aneurysm of anterior communicating artery. *B,* anteroposterior view. *C,* oblique view.

days after the arteriographic investigation, with complete relief of pain. There was no further drooping of the eyelid, but the inability to abduct the left eye persisted. This patient was seen one year after the operation. She had remained free of pain, but the abducens paralysis was still evident.

Supraclinoid Aneurysms of the Internal Carotid Artery. — Walker,[15] in reviewing 285 cases of intracranial aneurysms, observed that 71 verified aneurysms of the internal carotid artery had occurred above the clinoid process. He noted that headache or pain in the head was the most common complaint and was present for periods varying up to many years before the development of a subarachnoid hemorrhage, which occurred in 46 of the 71 patients. Half of the patients who had subarachnoid hemorrhages had no warning. In Walker's group of patients, failing vision and hemiplegia were the next most common symptoms. Diplopia is fairly frequent and is most often due to involvement of the oculomotor nerve but may be due to involvement of the trochlear or abducens nerve. Occasionally, papilledema is present.

Surgical treatment of supraclinoid aneurysms of the carotid artery consists mainly of cervical ligation of the internal carotid artery, which is probably inadequate alone; or this combined with ligation of the internal carotid artery intracranially; and clipping of the neck of the aneurysm.

Case 4 illustrates a large ruptured aneurysm of the supraclinoid internal carotid artery that was treated by the trapping method. The internal carotid was ligated in the neck, and a clip was applied to the internal carotid intracranially, distal to the aneurysm.

CASE 4. — A 63-year-old white woman had sudden, severe headache, followed in a few minutes by loss of consciousness for several minutes. Upon regaining consciousness, she complained of weakness of the right leg. Examination revealed mental confusion, weakness of the right leg and suppression of the reflexes of the right leg. A lumbar puncture done on admission revealed a pressure of 380 mm. of water, with grossly bloody spinal fluid. Routine roentgenograms of the skull were normal. Bilateral arteriographic study (Fig. 3, *A* and *B*) revealed a large aneurysm of the left internal carotid. After the arteriographic procedure this patient had mild expressive aphasia. It was decided that she could not tolerate immediate ligation of the internal carotid artery in the neck, and accordingly, several days later, the left internal carotid artery was exposed and gradually occluded with a clamp designed by Dr. Gayle Crutchfield. After three days the artery was completely occluded, without ill effects. Three days later a left frontal craniotomy was done, and two silver clips were applied intracranially to the left internal carotid, dis-

tal to the aneurysm (Fig. 3*C*). The neck of the aneurysm was too large to permit the application of clips. The patient had slight right hemiparesis and expressive aphasia for three weeks after the operation. When last seen, three months after the operation, she exhibited no significant neurologic abnormalities.

Aneurysms On or About the Circle of Willis.—The circle of Willis is formed in the front by the anterior cerebral arteries which are connected by the anterior communicating arteries. Behind are the two posterior cerebral arteries, which are branches of the basilar artery and are connected, normally, on each side with the internal carotid by a posterior communication. Aneurysmal lesions occur frequently on the proximal part of the middle cerebral at the circle of Willis and on the anterior cerebral and anterior communicating vessels. Aneurysms on the posterior communicating artery are extremely rare. Of 143 cases reported by Poppen[10] only two were on the posterior communicating, and they were present in 37 cases or 3.5 per cent of 1,023 cases reviewed by McDonald and Korb.[16] Aneurysms of the posterior cerebral arteries are also rare and were found in about 3 per cent of cases of intracranial aneurysmal lesions by McDonald and Korb.[16]

In Walker's review of 285 aneurysmal tumors,[15] he found 28 verified aneurysms of the proximal part of the middle cerebral artery, or approximately 10 per cent. An aneurysm of the proximal part of the middle cerebral artery cannot be diagnosed prior to rupture, which produces a subarachnoid hemorrhage. Hemiparesis or hemiplegia is usually present, with no involvement of the cranial nerve.

Aneurysms of the anterior cerebral and the anterior communicating arteries are usually not diagnosed until rupture occurs, but symptoms of headache may be present for months or years prior to rupture. After rupture, approximately 65 per cent of the patients lose consciousness, and those who regain consciousness may complain of some type of visual impairment without oculomotor palsies. There are usually no other localizing or lateralizing signs, and the lesions are usually located only by arteriographic studies. Ruptured aneurysms of the circle of Willis carry a mortality rate of about 35 to 50 per cent, about half of the patients dying in the first forty-eight hours. Recurrent bleeding has been reported by Hyland[17] as occurring in 20 per cent of the patients and by Hamby[18] in 50 per cent. Norlén and Olivecrona[19] estimated that the mortality rate for patients with the second attack is about seventy to 80 per cent.

The surgical treatment of aneurysms of the circle of Willis, whether they are on the middle cerebral, the anterior cerebral, the anterior communicating or the posterior communicating artery, is essentially the same; that is, it consists of cervical ligation or direct attack on the aneurysm. In the direct attack the neck of the aneurysm is occluded, if possible, by the use of clips or ligature, both proximal and distal to the aneurysm on the parent vessel; or by wrapping the aneurysm with hammered muscle or gelfoam for reinforcement.

Norlén[20] observed that 10 to 15 per cent of the patients who had undergone cervical ligation died of recurrent hemorrhages. Cervical ligation possibly offers some benefit to patients with aneurysms of the circle of Willis, but it is certainly not curative. With improved surgical technic and hypotensive and hypothermic anesthesia, the direct approach is becoming more and more the accepted procedure. Norlén and Olivecrona[19] pointed out that the mortality rate of intracranial operations is extremely high during the first two weeks after hemorrhage, because of impairment of the cerebral circulation, the presence of blood in the subarachnoid space or of clots in the

brain substance, producing increased intracranial pressure. Cerebral vasospasm is present from the beginning and usually lasts from two to three weeks. Hamby[14] has also pointed out that the mortality rate is decidedly lowered among patients who are operated upon after at least three weeks have elapsed since the initial hemorrhage.

To add support to the direct attack on aneurysms of the circle of Willis, Norlén and Barnum[21] reported 15 cases in which the neck of the aneurysm of the anterior communicating artery was clipped or ligated with one operative death. In the 14 survivors, there was no recurrent bleeding.

Although in my own opinion the only cure for aneurysms of the anterior part of the circle of Willis is the direct attack and although I have successfully applied a clip to the neck of an aneurysm in several cases, the following 2 cases illustrate some of the difficulties encountered when the direct approach is used. In the first instance the aneurysm ruptured during the dissection, with profuse bleeding, and in the second it was impossible to apply a clip to the aneurysm and was necessary to reinforce it with hammered muscle.

CASE 5.—A 14-year-old white boy had an onset of sudden severe headache, followed by unconsciousness for one hour. Upon awakening he had severe headache and stiffness of the neck, but no paralysis. Examination on admission to the hospital one day later revealed mental sluggishness, but there were no positive neurologic abnormalities. A lumbar puncture was done, revealing a pressure of 180 mm. of water with grossly bloody spinal fluid. Routine roentgenograms of the skull were normal. Bilateral percutaneous arteriographic study (Fig. 4, *A* and *B*) with 35 per cent diodrast revealed a small aneurysm on the left anterior cerebral artery just proximal to the anterior communicating artery. A left frontal craniotomy was done and the aneurysm exposed. It had an extremely thin wall, and the blood could be seen eddying within it. During the dissection and mobilization of this aneurysm so that a clip could be applied to the neck, there was a rupture with profuse bleeding. A clip was finally applied to the neck of the aneurysm and also to the anterior cerebral artery. The patient did not regain consciousness and died the next day.

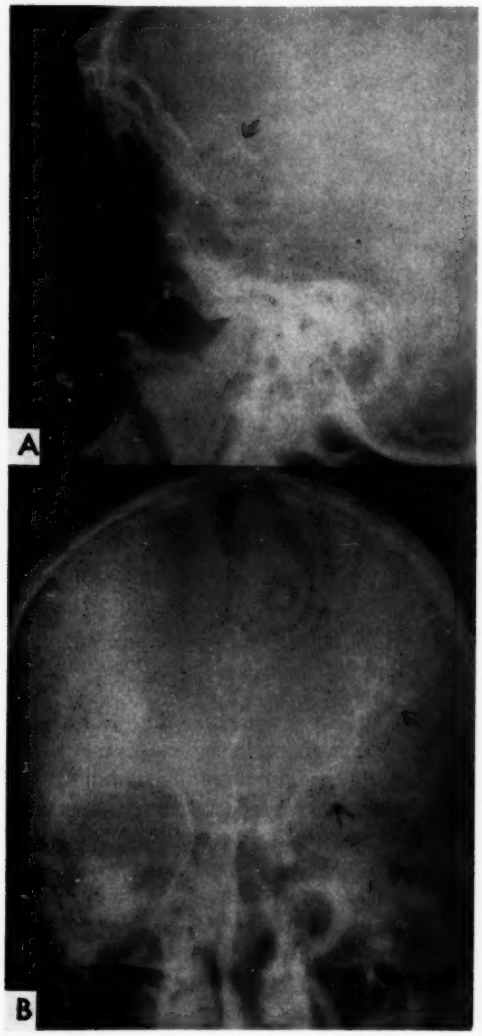

Fig. 6 *(Case 7).—A*, aneurysm of peripheral part of left middle cerebral artery. *B*, aneurysm of peripheral part of middle cerebral artery and elevation of sylvian vessels due to clot in temporal lobe.

CASE 6.—A 51-year-old white woman was admitted to the hospital because of a sudden, severe headache without loss of consciousness.

On admission she was confused, drowsy, and had a stiff neck, but the neurologic examination otherwise gave essentially negative results. Routine roentgenograms of the skull were normal. Bilateral arteriographic study (Fig. 5, *A, B* and *C*) revealed an aneurysm at the juncture of the right anterior communicating and the anterior cerebral artery. A right frontal craniotomy was done three weeks after admission and one week after the arteriographic procedure. The aneurysm was well exposed. The wall was extremely thin, but it was possible to apply a clip to the neck of the aneurysm. Accordingly, small strips of hammered muscle were wrapped around the aneurysm to reinforce it. The postoperative course was uneventful, and six months after the operation the patient was asymptomatic.

Aneurysm of the Peripheral Part of the Major Cerebral Vessels. — Aneurysms of the posterior cerebral artery constitute only about 3 per cent of intracranial aneurysms and can be diagnosed, as a rule, only by vertebral arteriographic study. Aneurysms of the peripheral part of the middle cerebral artery are relatively frequent and usually present themselves with sudden rupture, subarachnoid bleeding and an intracerebral hematoma in the area of the temporal lobe. The diagnosis of such an aneurysm can be made by the history and bloody spinal fluid and confirmed arteriographically. Treatment consists of evacuation of the hematoma and occlusion of the neck of the aneurysm. If the aneurysm is peripheral to the bifurcation of the middle cerebral artery and does not involve the main trunk of the middle cerebral artery, the results are much more satisfactory.

The following case is an example of an aneurysm occurring on the peripheral part of the left cerebral artery with sudden rupture, producing a hematoma in the left temporal lobe. Evacuation of the hematoma and removal of the aneurysm yielded a successful result.

CASE 7.—A 55-year-old white man had a sudden onset of severe headache while playing cards, with loss of consciousness. He regained consciousness the next day but was confused. He had severe headache and a stiff neck. Two days later there was a sudden increase in the severity of the headache, and he became semicomatose, with paralysis of the right side of the face and the right arm and leg. Examination revealed facial weakness on the right and flaccid paralysis of the right arm and leg. Routine roentgenograms of the skull were normal. A left percutaneous arteriographic study (Fig. 6, *A* and *B*) with 35 per cent diodrast was done, revealing an aneurysm on the peripheral part of the middle cerebral artery with elevation of the sylvians vessels, suggesting a mass in the left temporal lobe. A left temporal craniectomy was done, and a large intracerebral clot was removed from the temporofrontal region. A small aneurysm was observed on the branch of the middle cerebral artery; this was clipped and removed. After the operation, there was paralysis of the right arm and leg, as well as total aphasia. Six months after the operation, examination revealed returning function of both extremities, and the patient was able to speak fairly well. One year after the operation he was walking alone, talking well and using the right arm and hand for gross movements, but there was considerable spasticity of both extremities. He had several convulsive seizures of grand mal during the first year, controlled by anticonvulsant medication.

Peripheral aneurysms of the anterior cerebral artery are usually never discovered until bleeding occurs and arteriographic examination is done. Such an aneurysm is frequently associated with a hematoma in the frontal lobe. Surgical treatment consists of evacuation of the hematoma and the occlusion of the neck of the aneurysm.

In Case 8 the patient had a bleeding aneurysm of the left anterior cerebral artery, which produced a hematoma of the left frontal lobe extending into the ventricle. The hematoma was evacuated and the aneurysm removed with good results.

CASE 8.—A 39-year-old white man had a sudden onset of headache, with stupor and bloody spinal fluid. He was in the hospital for approximately two weeks under conservative treatment, with marked improvement. Suddenly, during the third week of hospitalization, severe

headache and coma recurred. A repeated spinal puncture revealed a pressure of 350 mm. of water, with bloody spinal fluid. Bilateral carotid arteriograms (Fig. 7) were taken, and an aneurysm was observed on the left anterior cerebral artery, which filled from the left injection. There was depression of the left anterior cerebral artery, suggesting a mass lesion. A left frontal craniotomy was done, and a large hematoma was observed in the frontal lobe, extending into the anterior horn of the left ventricle. The hematoma was removed by suction; a clip was applied to the neck of the aneurysm, and the aneurysm was removed. The postoperative course was stormy for several days, and the patient had pronounced weakness of both legs for approximately two weeks. When seen two months after discharge from the hospital, he was normal mentally and had no neurologic deficits.

Aneurysms of the posterior fossa are rare, and I have never encountered one except on postmortem examination. The basilar artery is frequently involved, producing multiple involvement of the cranial nerves. Diagnosis can be established by vertebral arteriographic study. Rizzoli and Hayes[22] reported the successful removal of a berry aneurysm of the left posterior inferior cerebral artery in the

Fig. 7 *(Case 8).*—Aneurysm of peripheral part of left anterior cerebral artery and depression of anterior cerebral artery due to hematoma of frontal lobe.

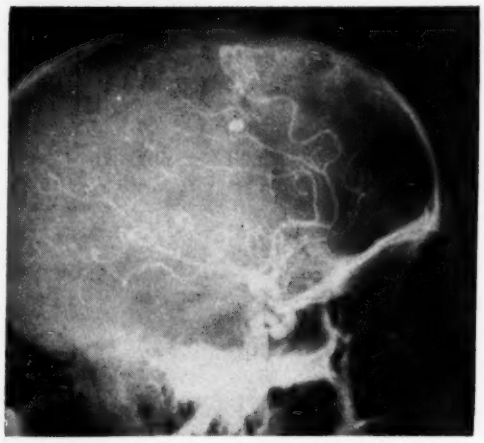

Fig. 8 *(Case 9).*—Arteriovenous aneurysm and small berry aneurysm in right frontal region. Note depression of anterior cerebral artery by an intracerebral hematoma.

case of a man who had a subarachnoid hemorrhage. The aneurysm was discovered on operation after a ventriculogram had revealed hydrocephalus with a shift of the fourth ventricle to the right.

Arteriorvenous Malformations.—Arteriovenous malformations, although they may occur in other areas, usually occur in the region of supply of the middle cerebral artery, though rarely in the posterior fossa. These lesions are most often on the cortex, with subcortical extension. They usually produce jacksonian or generalized seizures. The aneurysm ruptures and produces a subarachnoid hemorrhage in about 20 per cent of the cases. A patient with previous epilepsy in whom sudden subarachnoid bleeding occurs should be suspected of having an arteriovenous malformation. The bleeding may be entirely subarachnoid, or it may be associated with an intracerebral clot. Treatment consists of symptomatic therapy with anticonvulsive medication or operative intervention. Operative measures vary from cervical ligation to direct attack on the aneurysm. The smaller lesion may be excised; excision of

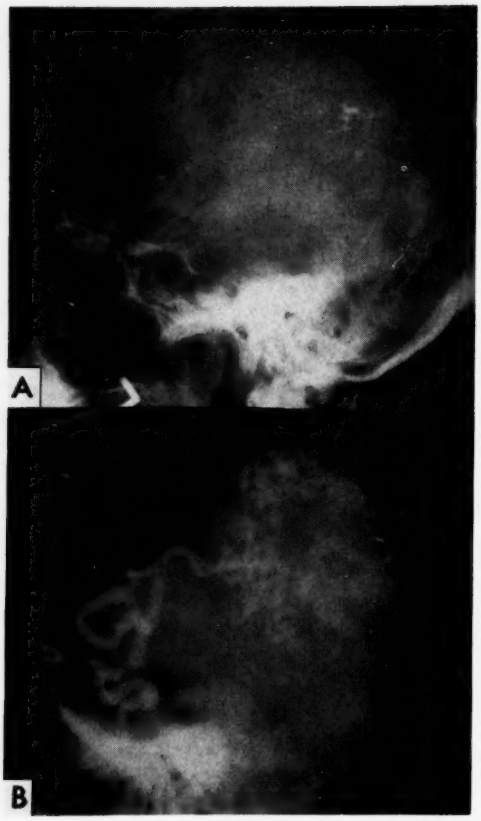

Fig. 9 *(Case 10).—A*, large area of calcification in left parietal region. *B*, large arteriovenous aneurysm in left parietal region at site of calcification.

the larger extensive lesions, however, in spite of modern technic and anesthesia, produces a high incidence of mortality and morbidity.

In the following 2 cases arteriovenous aneurysms were present.

In Case 9 a small arteriovenous lesion was associated with a small berry aneurysm over the frontal lobe which bled, producing a subarachnoid hemorrhage and an intracerebral clot. In Case 10 there was an extensive arteriovenous lesion on the left side, which was treated conservatively.

CASE 9.—A 14-year-old white girl had a sudden headache with loss of consciousness. On examination she was lethargic and had a stiff neck, with a positive Kernig sign. There was a positive Babinski sign on the left, with marked weakness of the left arm and leg. Ten days after onset a percutaneous arteriogram (Fig. 8) revealed an aneurysm high in the left frontal lobe, at the level of the coronal suture. A right frontal craniotomy was done, the clot evacuated and the arteriovenous malformation removed in toto. A small berry aneurysm was found, clipped and removed (Dr. W. P. Tice).

CASE 10.—A 53-year-old white man had severe headache and drowsiness several hours before admission to the hospital. He stated that he had had generalized convulsive seizures for the past several years. Examination revealed weakness of the right arm and leg, with a positive Babinski sign on the right. The tendon reflexes were slightly less active in the right arm and leg than in the left. A lumbar puncture revealed bloody spinal fluid with a pressure of 350 mm. of water. Routine roentgenograms of the skull (Fig. 9 *A*) revealed extensive calcification of the left parietal area. A left percutaneous arteriogram (Fig. 9 *B*) revealed an extensive angiomatous lesion of the left parietal region. The patient recovered from the subarachnoid hemorrhage, but because of the extensiveness of the lesion, surgical intervention was not attempted. He was discharged from the hospital on dilantin and phenobarbital. He continued to have an occasional convulsion but had no other complaints and enjoyed full use of his extremities.

SUMMARY

Aneurysms of the internal carotid artery below the clinoid, both unruptured and ruptured, can be adequately treated by cervical ligation alone or combined with intracranial clipping, thereby trapping the aneurysm. Supraclinoid aneurysms are best treated by the trapping method in most instances.

Aneurysms of the circle of Willis, with rupture, are associated with a mortality of 50 per cent or more. The incidence of recurrence may be as high as 50 per cent and approximately 70 to 80 per cent of pa-

tients die with the second attack. The mortality rate from surgical intervention, by direct attack on the aneurysm, is no more than 20 per cent, which is definitely lower than the mortality rate among patients who are left untreated.

Aneurysms of the peripheral portions of the major cerebral vessels are usually not diagnosed before rupture, at which time they produce a subarachnoid hemorrhage and frequently an intracerebral clot. The treatment of choice is the direct attack on the aneurysm, evacuation of the clot, and clipping of the neck of the aneurysm. Cervical ligation is probably of no significant benefit in the treatment of peripheral aneurysms.

Arteriovenous malformations are in many cases handled conservatively, particularly when the only symptoms are convulsive seizures. Smaller lesions can be satisfactorily removed by surgical means, but in many instances the larger lesions are impossible to remove without causing significant increases in mortality and morbidity.

ZUSAMMENFASSUNG

Sowohl geplatzte wie nicht geplatzte Aneurysmen der A. carotis int. unterhalb des Proc. clinoideus können erfolgreich durch blosse Ligatur am Halse oder in Verbindung mit Abkelmmung innerhalb des Schädels, wodurch das Aneurysma verödet wird, behandelt werden. Oberhalb des Proc. clinoideus liegende Aneurysmen werden in den meisten Fällen ambesten mit der Verödungsmethode behandelt.

Die Aneurysmen des Willisschen Zirkels haben, wenn sie einen Riss aufweisen, eine Sterblichkeit von 50 Prozent und mehr. Das Auftreten von Rückfällen kann eine Höhe von 50 Prozent erreichen, und ungefähr 70 bis 80 Prozent der Patienten sterben am zweiten Anfall. Die Sterblichkeitsquote als Folge eines direkten chirurgischen Angriffs auf das Aneurysma ist nicht höher als 20 Prozent und bestimmt niedriger als bei Kranken, die unbehandelt geblieben sind.

Aneurysmen der peripheren Abschnitte der grösseren Hirngefässe werden im allgemeinen nicht vor dem Platzen entdeckt; dann verursachen sie eine subarachnoidale Blutung und häufig ein Blutgerinnsel innerhalb des Gehirns. Die Behandlung der Wahl besteht in direktem Angriff auf das Aneurysma, Ausräumung des Gerinnsels und Abklemmung des Halses des Aneurysmas. Die Halsligatur bietet offenbar keine bedeutenden Vorteile.

Arteriovenöse Missbildungen werden in vielen Fällen, besonders wenn die einzigen Symptome in Krampfanfällen bestehen, konservativ behandelt.

Kleinere Veränderungen können auf chirurgischem Wege erfolgreich beseitigt werden, während die grösseren sich nicht ohne wesentliche Erhöhung der Sterblichkeit und der Morbidität resezieren lassen.

RIASSUNTO

L'aneurisma della carotide interna, sottoclinoideo rotto o non rotto, può essere trattato efficacemente con la legatura dell' arteria cervicale. Gli aneurismi sopraclinoidei, invece, sono da trattare preferibilmente con il metodo classico.

Gli aneurismi del poligono di Willis quando si rompono danno il 50% di mortalità. La frequenza delle recidive va fino al 50% e il 70-80% dei malati muoiono dopo il secondo attacco. La mortalità operatoria, nei casi di aggressione diretta dell'aneurisma, non è maggiore del 20%, il che è di gran lunga meglio di quanto avviene nei pazienti non operati.

L'aneurisma dei tratti più periferici delle arterie cerabrali più importanti di solito no viene diagnosticato prima della rottura, in coincidenza della quale deter-

mina una emorragia subaracnoidea o spesso un ematoma intracerebrale. La cura di scelta è l'attacco diretto dell'aneurisma. La legatura cervicale non porta alcun beneficio.

Le malformazioni arterovenose sono spesso trattate conservativamente specie quando i sintomi sono soltanto di tipo convulsivo.

Le lesioni più piccole possono essere asportate chirurgicamente con successo, ma in molti casi quelle più gravi non possono essere asportate senza causare un ecessivo aumento della mortalità e della morbilità.

RÉSUMÉ

Les anévrismes de la carotide interne au-dessous de la clinoïde—rupturés ou non —peuvent être traités—efficacement par la ligature cervicale seule, ou combinée avec le pincement intracranien, bloquant ainsi l'anévrisme. Cette méthode de "bloquage" est la plus efficace dans la plupart des cas d'anévrismes supraclinoidiens.

Les anévrismes rupturés du polygone de Willis présentent un taux de mortalité de 50% et plus. Le taux de récidive peut atteindre 50%, et la deuxième atteinte est mortelle dans environ 70 à 80% des cas, alors que la mortalité après intervention chirurgicale n'est que de 20%, dont beaucoup plus basse que sans traitement.

Les anévrismes des artères distales des gros vaisseaux intracraniens ne sont en général pas diagnostiqués avant la rupture; ils provoquent à ce moment une hémorragie sous-arachnoïdienne et, fréquement, un caillot intracérébral. Le traitement de choix est l'attaque directe de l'anévrisme, l'évacuation du caillot, et le pincement du collet de l'anévrisme. La ligature cérébrale est probablement sans grand effet.

Les vices de conformation artérioveineuse sont traités de manière conservatrice dans bien des cas, surtout lorsque les seuls symptômes consistent en crises convulsives.

Les lésions de peu d'importance peuvent être extirpées chirurgicalement: quant aux autres il est souvent impossible de les exciser sans causer une augmentation importante du taux de mortalité et de morbidité.

RESUMEN

Los aneurismas de la arteria carótida interma debajo de la apófisis clinoides, tanto rotos como intactos, pueden tratarse adecuadamente por ligadura cervical sola ó combinada con pinzamiento, intracraneal, aislando así, el aneurisma Los aneurismas supraclinoideos se tratan mejor por ete método en la mayoría de los casos.

Los aneurismas del polígono de Willis, dan cuando se rompen, una mortalidad de 50 por ciento ó más. La incidencia de la recidiva puede ser hasta de 50 por ciento y aproximadamente 70 a 80 por ciento de los pacientes mueren en el segundo ataque. La mortalidad operatoria por intervención directa sobre el aneurisma no es mas del 20 por ciento, evidentemente menor que la mortalidad de los pacientes no tratados.

Los aneurismas de las porciones periféricas de los vasos cerebrales mayores generalmente no se diagnostican autes de su ruptura, y cuando esta sucede produce hemorragia subaracnoidea y frecuentemente un hematoma intracerebral. El tratamiento de elección es la intervención directa sobre el aneurisma, evacuación del coágulo y prinzamiento del cuello del aneurisma. La ligadura cervical probablemente no tiene importancia.

Las malformaciones arteriovenosas son tratadas en muchos casos por métodos conservadores, particularmente cuando los síntomas son solo crisis convulsivas.

Las lesiones pequenas pueden ser extirpadas satisfactoriamente, pero en muchos

casos las lesiones mayores son imposibles de extirpar sin causar una alza en las mortalidad y morbilidad.

SUMARIO

Os aneurismas da carótida interna, abaixo da apófise clinóide, rotos ou não, podem ser tratados corretamente pela ligadura cervical isolada ou em combinação com a hemostasia intra-craniana. Os aneurismas supra-clinoidianos são melhor tratados pelo grampeamento.

Os aneurismas do triangulo de Willis, quando há rutura, elevam a mortalidade a 50% ou mais. A incidência de recidiva pode atingir 50% e em, aproximadamente, 70-80% os doentes morrem no segundo ataque. A taxa de mortalidade por intervenção cirúrgica sobre os aneurismas não é maior que 20%, cifra que é indiscutivelmente mais baixa que a da mortalidade entre os pacientes não tratados.

Os aneurismas das porções periféricas dos grandes vasos cerebrais não são habitualmente diagnósticados antes da rutura, período em que provocam hemorragia subaracnóide e frequentes coágulos intracerebrais. O melhor tratamento é accesso cirúrgico direto ao aneurisma, com evacuação do coâgulo e e grampeamento no colo do aneurisma. A ligadura cervical parece não exercer beneficio significativo.

As malformações arterio-venosas são, em muitos casos, tratadas conservadoramente, sobretudo quando os sintomas são apenas crises convulsivas.

As lesões menores podem ser ressecadas com êxito cirúrgicamente, mas, em muitos casos as lesões maiores são impossiveis de remover sem causar maiores mortalidade e morbilidade.

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Postmeningitic Subdural Effusions

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A NEW development in pediatrics has been the observation that subdural effusions frequently follow meningitis. We should like to summarize our experience in the past several years with this phenomenon and indulge in a few speculations as to its pathogenesis.

Subdural effusions are exudate-free collections of fluid in the subdural space, containing protein in amounts varying from 15 to 2,000 mg. per hundred cubic centimeters, with cell counts of a few to several hundred, usually lymphocytes and crenated red cells. The volume of this fluid varies from 5 to 70 cc. on each side. Though it frequently appears on one side at first, it is usually on both sides. The presence of a subdural effusion is to be suspected in any anorexic, listless, irritable child recently treated for bacterial meningitis. Customarily there are no focal neurologic signs. The fontanel has been described as tense and bulging, but in our experience it is usually soft and pliant. The diagnosis is readily made by inserting a needle to a depth of 2 to 3 mm. in the subdural space at the extreme lateral angle of the fontanel and withdrawing the fluid. If a large quantity is removed, there is frequently a prompt and dramatic temporary improvement in the child's appearance and performance.

The commonest cause of subdural effusion is purulent meningitis. The incidence is not definitely known, but several large pediatric institutions have reported from 30 to 60 per cent. We estimate that the incidence is about 50 per cent in children whose fontanels are open. Consequently we have recommended tapping the subdural space in all cases of meningitis in infants under 18 months of age.

Although subdural effusion appears to be a new syndrome, actually it is quite old and was referred to even by Hippocrates. Antibiotics have altered the statistics of mortality due to meningitis, and an increasing incidence of subdural effusions may be expected. Physicians have been understandably relieved and gratified that children with meningitis have been saved, but it now appears that perhaps morbidity as well as mortality can be further minimized, thus reducing the number of "survival syndromes." As has been stated, in our opinion subdural effusion is not only a common complication but is probably correctible.[1b] Conversely, if it is not recognized or is neglected, a neomembrane forms, similar to that associated with posttraumatic subdural hematoma. This membraneous envelope is tough, vascular and often laminated. Microscopic examination shows mature fibrocytes, collagenous fibrous tissue and many new blood vessels (see illustration).

One consequence of a persistent neomembrane is constriction of the brain. In contrast to the static size of the adult brain, the infant brain doubles in volume in the first three months and doubles again in the next six months.[2] If the thick sub-

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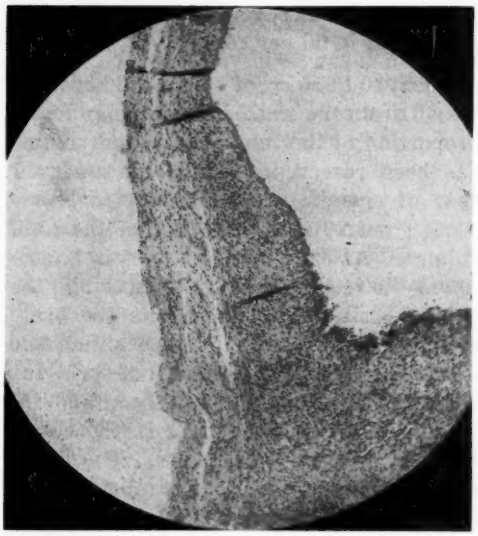
dural membrane is permitted to remain and does not stretch or yield with growth, the brain of the infant is maintained in a confined space by this envelope, and the blood supply and fluid dynamics are further embarrassed. This may eventuate in mental retardation and epilepsy.[3] From the reports of others[4] and our own observations, several generalizations can be made: 1. Subdural effusions occur in a high percentage of cases of so-called "cured" meningitis. 2. The diplococcus, the meningococcus and Haemophilus influenzae are the organisms most likely to cause subdural effusions, but other forms of meningitis may be responsible, e.g., those due to E. Typhi and M. Tuberculosis. 3. The effusion is frequently bilateral, though it may begin as a unilateral collection. 4. Finally, drainage of the subdural space is necessary and desirable and usually effects dramatic if only temporary improvement. We have observed subdural effusions in association with conditions other than the postmeningitic state: diseases of the respiratory tract and diarrhea, as well as malnutrition — a phenomenon that deserves wider recognition. As has been stated, this "new" syndrome is probably appearing more frequently nowadays since children treated with antibiotics survive and these complications have an opportunity to develop.

The cause of subdural effusions in meningitis and in nonmeningitic states still is not known. It is suspected, however, that any condition that causes a separation of the dura from the arachnoid may cause tearing of the bridging veins in the subdural space, resulting in a small subdural hematoma. The subsequent liquefaction of this blood, highly charged with protein, may exert osmotic tension upon the circulating spinal fluid beneath the arachnoid, drawing it into the subdural space and further increasing the volume. This chain



Portion of subdural neomembrane surgically removed, showing fibrocytes, new blood vessels and lamination (hematoxylin and eosin). (Reproduced by courtesy of the Armed Forces Institute of Pathology.)

of events may occur after spinal air injection in the infant under 2 years of age, as was pointed out by Smith and Carothers.[5] It may also occur after an operation for hydrocephalus, as reported by Anderson.[6]

On the basis of the foregoing theory we speculated that excessive withdrawal of spinal fluid for diagnostic purposes in the case of an infant with suspected meningitis might create a similar sagging of the brain and tearing of the bridging veins that could initiate this sequential reaction.

We noted that, in many instances, unnecessarily elaborate laboratory tests required a volume of 10 to 15 cc. of spinal fluid, and that this amount was being regularly withdrawn from infants for diagnostic studies. Dr. Hattie Alexander, an authority on the treatment of bacterial meningitis in children, has stated that in her clinic it is customary to withdraw 10 to 15 cc.[7] She too reports an incidence of

subdural effusions complicating bacterial meningitis in 50 per cent.

When 10 to 15 cc. of spinal fluid is withdrawn from the small infant, a significant proportion of the total spinal fluid volume has been reserved. In infants under 1 year of age the amount extracted represents from 20 to 33 per cent of the total volume. After spinal puncture it is customary to return the baby to its crib in the supine position. This permits the brain to fall posteriorly within the cranium and makes possible the rending of bridging veins; in addition, it may encourage the leaking blood to accumulate in the neighborhood of the frontal poles. The development of subdural effusions following this bleeding would therefore be most pronounced over the frontal areas, an observation often confirmed by direct visualization at the time of operation.

If the plausibility of this explanation had not been sufficiently compelling to cause us to reduce drastically the volume of fluid withdrawn, two further observations crystallized our decision in this matter. One concerned a child eventually shown to have had benign lymphocytic choriomeningitis, although at first tuberculous meningitis was suspected. Repeated lumbar punctures over two or three days, with the withdrawal of 10 to 15 cc. at each lumbar tap, was associated with the development of a sterile subdural effusion of 70 cc. on one side and 40 cc. on the other. Yet this child had viral, not bacterial meningitis.

Second, we observed an infant born with a lumbar meningocele, the surgical repair of which was undertaken. At the time of operation the child was prone on the operating table, with the head turned to the left for administration of an anesthetic. The meningocele was opened, and a considerable quantity of cerebrospinal fluid escaped. After the repair the child's head started to grow, though not with the usual contour seen in children with obstructive hydrocephalus. After a circumferential increase of over 2 cm. had occurred, an additional operation was advised to correct the "hydrocephalus." When an attempt was made to do a ventriculogram, however, a clear subdural effusion of approximately 35 cc. was observed on the left side. This was the side that was uppermost during repair of the meningocele and the side from which the brain would fall away with the escape of excessive fluid. A craniotomy was done, with evacuation of xanthochromic fluid and removal of a subdural membrane. The ventricles were tapped and proved to be of normal size. Since his second operation the child has done well.

On the basis of these observations a program was instituted at the Children's Hospital in Washington, D. C., requiring that diagnostic spinal punctures be limited to one tap and to a maximum withdrawal of 3 cc. of fluid. This practice went into effect in January 1955. From January 1 to August 15 there were 27 patients with bacterial meningitis admitted to the hospital. During this time only 3 cases of subdural effusion (5 cc. or more) were observed; the largest amount recovered in any case did not exceed 8 cc. None of these children required operation. A review of the hospital statistics of previous years showed an expected incidence of 50 per cent of subdural effusions complicating bacterial meningitis.

In earlier reports we called attention to the presence of subdural effusions in nonmeningitic illnesses, such as infantile diarrhea, malnutrition, et cetera.[8] In reviewing this material, however, we noted that, at the time of admission to the hospital, all of these children were suspected of having meningitis and had undergone spinal punctures. No meningitis was pres-

ent, and it is possible that the spinal punctures induced the later development of a subdural effusion.

Further, a controlled group of meningitic patients from another service was used for comparison. In this control group no restrictions were imposed on the volume of fluid removed. Of 20 infants under the age of 1 year, 5 underwent one subdural tap; 15 had two or more. Subdural effusions were present in 9, and craniotomy was required in 7. A further neurologic and physiologic study is in progress with this group.[9]

It appears, therefore, that the preponderance of subdural effusions observed in infants subsequent to meningitis may be iatrogenic. By restricting the amount of cerebral spinal fluid withdrawn at the time of the diagnostic tap, therefore, the surgeon may avoid such complications.

CONCLUSION

Subdural effusions have emerged as a serious complication in the treatment of bacterial meningitis and may result in a "survival syndrome" in a bacteriologically cured but neurologically damaged child.

Their presence is easily recognized by performing bilateral subdural taps through the open fontanel in any child whose clinical response to antibiotic therapy is unsatisfactory.

In the authors' opinion, subdural effusions in children may be inadvertently induced by excessive withdrawal of fluid at the time of the diagnostic spinal tap. In their experience, when the total volume of fluid withdrawn by lumbar puncture was reduced to 3 cc., the incidence of subdural effusions as a complication following bacterial meningitis was decidedly reduced.

CONCLUSIONS

Les épanchements sous-duraux sont apparus comme une complication sérieuse lors du traitement de la méningite bactérienne.

Leur présence est aisément décelable par des ponctions sousdurales bilatérales par la fontanelle ouverte chez tous les enfants ne réagissant pas favorablement à la thérapeutique antibiotique.

Selon les auters les épanchements sous-durax chez l'enfant sont dus à une ponction excessive — par inadvertance — de liquide au cours de l'examen explorateur. Les auteurs ont observé aussi que si l'on réduit à 3 cc le volume du liquide ponctionné, les épanchements sous-duraux consécutifs à la méningite bactérienne sont supprimés.

SCHLUSSFOLGERUNGEN

In der Behandlung der bakteriellen Hirnhautentzündung haben sich die subduralen Ergüsse als ernste Komplikation herausgestellt.

Ihr Bestehen lässt sich durch doppelseitige subdurale Punktionen durch die offene Fontanelle bei Kindern, die auf antibotische Behandlung ungenügend ansprechen, leicht feststellen.

Die Verfasser glauden, dass subdurale Ergüsse bei Kleinkindern unwillkürlich durch übermässiges Ablassen von Flüssigkeit bei der diagnostischen Punktion hervorgerufen werden können. Sie konnten beobachten, dass es zut keinen subduralen Ergüssen nach bakterieller Gehirnhautentzündung mehr kam, wenn die Gesamtmenge der entzogenen Spinalflüssigkeit auf 3 ccm reduziert wurde.

CONCLUSIONI

Le soffusioni subdurali sono una grave complicazione della meningite batterica.

La loro presenza è facilmente dimostrabile esaminando gli spazi subdurali attraverso al fontanella in ogni bambino in cui i risultati della terapia antibiotica non siano soddisfacenti.

Secondo l'autore queste soffusioni subdurali sono dovute all'eccessiva estrazione di liquido. Infatti se il volume totale di liquido estratto vienne ridotto a 3 cc. le soffusioni non compaiono.

CONCLUSOES

As efusões subdurais surgiram como grave complicação no tratamento da meningite bacteriana.

Sua presença é fàcilmente reconhecida fazendo-se "vaps" subdurais bilaterais através da fontanela aberta em qualquer criança cujas respostas clínicas à terapia antibiótica sejam insatisfatórias.

Na opinião do autor, as efusões subdurais em crianças são inadvertidamente causadas pela remoção excessiva de fluido em qualquer ocasião do diagnóstico. Finalmente, quando o volume total de fluido retirado foi reduzido para 3 cc., observaram que as efusões subdurais que se seguiam à meningite bacteriana eram abolidas.

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A Study of a Series of Myelograms

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MYELOGRAPHY is a roentgen diagnostic procedure using contrast roentgenography to outline the subarachnoid space of the spinal cord.

With ordinary roentgen technics the bony vertebral bodies, arches, processes and facets are visible. Invisible are the spinal cord and its three meninges, the nerve roots, the intervertebral disc and other soft tissues. If the physician can not visualize a soft part, he attempts to fill or outline that part with some substance he can see. For example, he cannot see a stomach; therefore he fills it with barium. With the fluoroscope and roentgen plates he sees the barium and interprets the shadows and densities. A crater or ulcer appears in profile as a projecting finger of barium. In a similar way, with the myelogram one floats a radiopaque oil in the watery subarachnoid spinal fluid. The globule of oil floats like the bubble in a spirit level (reversed—the oil is actually heavier than water). Then with the fluoroscope, the physician can see the oil. He can elevate the patient's head and watch the oil globule float caudad. He can take roentgen plates of any area that seems interesting, for detailed study at his leisure. The oil, appearing like mercury or molten lead, outlines the subarachnoid space. If there is a space-occupying lesion in the cord, the cauda equina or the spinal canal, it may be demonstrated as a transparent area where no oil can flow. The mass may cause a filling defect in the regular shape of the oil globule. The shape of the myelographic shadows must be interpreted and correlated with the clinical data, so that the taking of myelograms becomes one more laboratory test that may (or may not) aid the physician in understanding his case. Like other laboratory procedures, myelographic study is not perfect. It has a percentage of error. It is the purpose of this study to identify the errors and measure their frequency.

Indications.—The indications for myelograms are few and simple:

1. To demonstrate the presence of a mass in the spinal canal. Example: Tumor, herniated nucleus pulposus.

2. To rule out the presence of such masses before any other operation is performed. Example: Before spinal fusion for spondylolisthesis, if the patient has had obvious nerve root pressure.

3. To outline the subarachnoid space in the presence of congenital anomalies. Example: Before operation in cases of spina bifida.

The contraindications are probably harder to specify, but the following conditions may be considered.

1. The presence of infection in the cord or its meninges.

2. Emotional instability in the patient. No specific example need be listed, since all surgeons have encountered patients who attribute their headaches, ulcers and pes planus to a diagnostic lumbar puncture.

3. Any degenerative disease of the brain or cord, such as multiple sclerosis.

4. General systemic debility, or serious illness.

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Conditions. — There are certain conditions that may be judged important or worthless but which have been scrupulously followed in obtaining the series of myelograms here described:

1. The surgeon should state his clinical diagnosis accurately and in writing.

2. The patient should be alert, not sedated, warm and well fed.

3. The patient should have had the theory of the procedure explained to him.

4. The surgeon should describe to the patient every single step of the procedure before it happens.

5. The surgeon should do the lumbar puncture.

6. The surgeon should have full accommodation or "night vision" for fluoroscopic study.

7. The surgeon should observe every single phase of the fluoroscopic examination and request roentgen plates of those scenes which the roentgenologist does not film but which the surgeon may consider important.

8. The patient should be told that he may have a headache, and suitable medicaments should be provided.

9. The roentgenologist's interpretation and the clinician's interpretation of the fluoroscopic data and of the roentgen plates should be made separately and in writing.

10. The patient should remain nearly horizontal after the procedure for at least four hours. The patients in this series were hospitalized overnight.

No elaborate discussion of these conditions is necessary. An ignorant, frightened, startled, half-narcotized patient can hardly be cooperative. The opinion of a competent roentgenologist is enormously valuable; but so likewise are the direct observations of the clinician who has heard the patient's complaints and examined his body. Myelograms should never be taken because of curiosity. If a conservative regime of empiric therapy has been adopted, the myelogram is unnecessary. The myelogram should be used only when the clinician is competent and prepared to utilize the information he gains thereby.

Procedure.—There is tremendous variation in the details of myelographic study. One technic calls for filling the subarachnoid space with 30 cc. of oil. Some insert the lumbar puncture needle at the fifth lumbar interspace. Many surgeons place great emphasis on retrieving the contrast medium, doing multiple punctures to obtain the last few drops. This is the procedure followed throughout the series of myelograms reported here.

1. The back is shaved and prepared.

2. The patient is placed in the left lateral position, knees to chest.

3. Five cc. of 1 per cent procaine hydrochloride is injected with a No. 25 needle intradermally and subcutaneously.

4. A lumbar puncture with a No. 19 needle is done by the surgeon at the interspace between the second and third lumbar spinous processes unless the presence of pathologic change is suspected.

5. Five cc. of spinal fluid is obtained for laboratory determination of the cell count and the protein level. This enables the surgeon to observe the flow and clarity of the spinal fluid.

6. Three cc. of the iodized oil contrast medium is slowly injected with no great pressure, the oil being allowed to flow smoothly through the No. 19 needle.

7. The stilet is replaced in the lumbar puncture needle but the needle is left *in situ*.

8. With the surgeon's hands placed firmly on the patient's torso, the patient is instructed to turn to the prone position. (The phrase "flat on your belly" is often used nowadays, since that phrase is almost impossible to misunderstand. If the patient turns the wrong way it could be dan-

TABLE 1.—*Myelographic Diagnosis*

Correct Myelographic Diagnosis	*Total*		*Male Patients*		*Female Patients*	
	Cases	*Decisions*	*Cases*	*Decisions*	*Cases*	*Decisions*
Normal myelogram, no lesion	2	2	1	1	1	1
"Positive" myelogram, 3 lesions	1	3	1	3	—	—
"Positive" myelogram, 2 lesions	9	18	5	10	4	8
"Positive" myelogram, 1 lesion	51	51	37	37	14	14
"Positive" myelogram, 1 lesion, plus 1 "false positive"	6	6	6	6	—	—
	69	80				

Wrong Myelographic Diagnosis	*Total*		*Male Patients*		*Female Patients*	
	Cases	*Decisions*	*Cases*	*Decisions*	*Cases*	*Decisions*
Normal myelogram, 2 lesions present at operation	2	2	2	2	—	—
"Positive" myelogram, no lesions present at operation	6	6	3	3	3	3
"Positive" myelogram, 1 lesion, plus 1 "false positive"	6	6	6	6	—	—

gerous.)

9. The roentgenologist tapes lead skin markers to identify the right side and the individual vertebrae. The surgeons don protective gowns. Lights are extinguished. Glasses are raised.

10. The location of skin markers is determined fluoroscopically and corrected if necessary.

11. The oil is located, and the table is tilted (either way) slowly and gently. It is important to keep the 1/10 ounce of oil together in a fat little globule. If the globule becomes elongated to a thin string of radiopaque material, it cannot outline any masses that may be in the area.

12. In a lumbar myelogram, examination includes the caudal sac near the second sacral vertebra and extends cephalad at least two interspaces above the location of the lesion as specified by the physician. It is kinder and wiser for the physician to tell the roentgenologist where he may expect to locate the lesion.

13. Roentgen films are taken in the anteroposterior, left oblique and right oblique views of all suspicious areas.

14. The medium is placed under the spinal needle at conclusion of the myelographic procedure. When the fluoroscopic study is concluded, the room is lighted. Such oil as can easily be obtained is aspirated. If 2 cc. is obtained, it is considered plenty indeed. If only 1 drop is withdrawn it is accepted, and the patient is "needled" no more.

15. The patient is transferred supine to a litter and then to his bed, where he remains head down for at least four hours.

Material.—This series of myelograms was taken by one surgeon, with several roentgenologists. There are 125 cases, in which 76 patients were men and 49 were women. The average age of the men was 39 years; that of the women, 37.6 years. Of the 125 myelograms, there were 101 (82 per cent) that showed filling defects; 24, or 18 per cent, seemed normal. It may be interesting that the men had 65 positives and 13 negatives. Roughly then, a positive myelogram is obtained in 8 out of 10 cases when the cases are selected and a diagnosis made prior to the roentgen procedure.

The relation of the myelographic to the clinical picture is the most important information obtained from this study. Of 101 positive myelograms, 59 per cent confirmed the clinical diagnosis exactly; 19 per cent confirmed the presence of a space-occupying intraspinal lesion, but corrected the location specified by the doctor; 22 per cent confirmed the clinical diagnosis and supplemented it with additional filling defects. It is possible to interpret these statistics to prove that in 81 per cent of the cases the surgeon predicted the lesion accurately. Such an interpretation is rashly optimistic. The same three values also clearly indicate that the surgeon using clinical diagnoses only could have found himself exploring the wrong interspace in almost half of the cases. If the agreement between clinical diagnoses and myelograms were perfect, there would be no need for myelograms. Until his skill in diagnosis reaches such perfection, the surgeon can hardly afford to operate without a myelogram.

Multiple filling defects were surprisingly frequent. Eighteen men and 5 women showed these, to make up 22 per cent of all whose myelograms were "positive." Of the 65 men with positive defects, 4 underwent no operation, and the presence of the defects cannot be confirmed; 1 had 3 herniated nuclei pulposi; 5 had 2 herniated nuclei pulposi; 2 had hemangiomatoma; 6 had 1 herniated disc plus 1 "false positive." Of the 5 women with multiple defects, 1 was not operated on; 4 had 2 herniated nuclei pulposi.

"False positive" myelograms are detected only by operation. The surgeon finds no space-occupying lesion where the myelogram showed a filling defect. Single instances of this occurred in 6 cases; 3 of the patients were men and 3 were women. This means that both the clinical diagnosis and the myelogram were "positive," that the surgeon was operating at the correct interspace, that the myelographic markers had been properly placed, and that a normal spinal canal was present. In addition to these 6 "false positive" results, there were 6 cases (all with male patients) in which the myelogram showed multiple defects, 1 of which was a "false positive."

"False negative" myelograms are also possible. This means that a clinical diagnosis is made, the myelogram is normal, operation is performed in spite of this, and a space-occupying lesion is demonstrated. There were 2 such cases in this series. In both, the patients were operated on by another surgeon. The pathologic condition was present, but the myelogram did not demonstrate it. The number of "false negative" myelograms would be slightly larger if the roentgen interpretations considered were those of the roentgenologist, but in this study the interpretations were those of the surgeon. Since both "false positive" and "false negative" myelograms are possible, the question arises: just how accurate are myelograms? Table 1 lists the number of decisions made by roentgen study and checked at operation.

In the cases of 77 patients operated on, therefore, 94 decisions or determinations were made by myelogram, of which 80 (85 per cent) were correct, and 14 (15 per cent) were erroneous.

If there is disagreement between the roentgenologist's and the surgeon's interpretation of the myelogram, how great is this difference of opinion? In this series of 125 cases, the surgeon and the roentgenologist agreed on the absence of lesions 26 times and on their presence 89 times; in other words, the two were in harmony in 92 per cent of the cases. In the 10 cases in which their opinions differed, the roentgenologist was proved correct by the operation in 1 case and the surgeon in 6 cases. On 3 cases no operation was performed by which the opinion of either

could be verified.

Five per cent of operative patients had tumors. Three were hemangiomas and 1 a teratoma of the filum terminale. Only 1 hemangioma and the teratoma were recognized as tumors from the myelogram before the operation.

The most common site of herniated nucleus pulposus is often said to be at the fifth lumbar disc interspace. This was not true in the series here reported. The fourth lumbar interspace was the most common site for myelographic filling defects (Table 2). This is not a study of surgical cases, but when the surgical data are considered, L5 is twice as frequent as L4 in women, and L4 is twice as frequent as L5 in men (Table 3). No interpretation of these findings is offered. Perhaps a larger series of cases would change the proportions.

TABLE 2.—*Location of Defects by Myelogram*

	Female Patients	*Male Patients*	*Total*
L1	—	1	1
L2	—	1	1
L3	5	10	15
L4	15	45	60
L5	18	19	37

TABLE 3.—*Location of Lesions at Operation*

	Female Patients	*Male Patients*	*Total*
L1	—	—	—
L2	—	1	1
L3	1	4	5
L4	7	32	39
L5	15	16	31

SUMMARY

Myelograms done in 125 consecutive cases are reported. Eighty-two per cent of all showed positive filling defects. The agreement between clinical diagnosis and positive myelographic evidence is as follows: In 59 per cent the clinical diagnosis was confirmed exactly; in 19 per cent the location of the lesion was corrected; in 22 per cent the clinical diagnosis was confirmed and additional filling defects were present. The incidence of multiple defects was 22 per cent. In 12 cases there were "false positive" myelograms, and in 2 there were "false negative" myelograms, when checked by operation.

The accuracy of the myelograms is computed by the number of decisions made by myelogram and proved or disproved by operation. The myelogram is correct in 85 per cent of the cases.

The percentage of agreement of myelographic interpretation between radiologist and surgeon is 92 per cent.

The indications and contraindications for myelographic study are mentioned. Specific conditions are suggested. The procedure used in the series reported is outlined.

RÉSUMÉ

L'auteur présente les myélogrammes de 125 cas consécutifs. Dans 82% des cas des défauts de remplissage ont été constatés. Le rapport entre le diagnostic clinique et le myélogramme "positif" a été le suivant: 59% des cas ont confirmé le diagnostic clinique, 19% ont permis de corriger la localisation diagnostiquée et ont révélé des défauts de remplissage supplémentaires. La fréquence des lésions multiples a été de 22%. Il y a eu 12 cas de "faux myélogrammes positifs," et 2 cas de "faux myélogrammes négatifs" vérifiés à l'opération.

La précision des myélogrammes a été évaluée selon le nombre de décisions opératoires dictées par ces examens, dont

l'intervention a confirmé ou infirmé indications.

Les diagnostic établis grâce aux myélogrammes ont été exacts dans 85% des cas.

Les diagnostics établis en collaboration entre le radiologue et le chirurgien quant à l'interprétation des myélogrammes se sont révélés exacts dans 92% des cas.

Les indications et contre-indications de la myélographie sont énumérées. L'auteur suggére quelques conditions spécifiques et décrit la technique utilisée dans les 125 cas rapportés.

ZUSAMMENFASSUNG

Es wird über eine Reihe von 125 aufeinander folgenden myelographischen Untersuchungen berichtet. In 82 Prozent wurden positive Füllungsdefekte beobachtet. Ein Vergleich der klinischen Diagnosen mit den "positiven" Myelogrammen ergab folgendes: In 59 Prozent wurde die klinische Diagnose benau bestätigt; in 19 Prozent wurden die klinische Lokalisierung durch das Myelogramm korrigiert und zusätzliche Füllungsdefekte beobachtet. Das Vorkommen mehrfacher Defekte betrug 22 Prozent. In 12 Fällen ergab die Operation, dass es sich um "falsche positive" Myelogramme handelte, und in 2 Fällen lagen "falsche negative" Myelogramme vor.

Die Zuverlässigkeit der Myelogramme wurde nach der Anzahl der auf Grund der Röntgenbilder getroffenen Entscheidungen und der bestätigenden oder widerlegenden Operationsbefunde berechnet.

In 85 Prozent der Fälle war das Myelogramm korrekt.

Der Prozentsatz der Fälle, in denen der Röntgenologe und der Chirurg in der Beurteilung des Myelogramms übereinstimmten, betrug 92 Prozent.

Die Indikationen und Gegenindikationen der myelographischen Untersuchung werden erwähnt. Besondere Untersuchungsbedingungen werden in Vorschlag gebracht, und die in der vorliegenden Serie angewandte Methode wird umrissen.

RIASSUNTO

Sono riportato i mielogrammi presi in 125 casi conscutivi. Nell'82% dei casi si osservò un difetto di riempimento. Il rapporto fra diagnosi clinica e riempimento positivo fu il seguente: nel 59% si confermò esattamente la diagnosi clinica; nel 19% venne corretta la localizzazione fatta con la sola diagnosi e si misero in evidenza altri difetti di riempimento. La frequenza di difetti multipli fu del 22%. In 12 casi si ebbero dei "falsi mielogrammi positivi" e in due casi dei "falsi mielogrammi negativi," come si ebbe a riperire durante le operazioni.

L'accuratezza dei mielogrammi si potè computare dal numero delle decisioni prese coi mielogrammi stessi e confermate o no dall'intervento chirurgico.

I mielogrammi furono eseguiti nell'85% dei casi.

La percentuale di accordo fra radiologo e chirurgo, per quanto riguarda l'interpretazione dei mielogrammi, fu del 92%.

Vengono qui ricordate le indicazioni e le controindicazioni per la mielografia; vengono suggerite delle condizioni specifiche e sottolineata la procedura usata nei casi riportati.

RESUMEN

Se reportan 125 mielogramas tomados en casos consecutivos. En 82 por ciento defectos de llenamiento positivos fueron observados. La concordancia entre el diagnóstico clínico y el mielograma "positivo" fué como sigue; en 59 por ciento confirmó el diagnóstico clínico exactamente; en 19 por ciento corrigió la localización concebida en el diagnóstico y reveló defectos de

llenamiento adicionales. La incidencia de defectos múltiples fué 22 por ciento. En 12 casos hubo mielogramas "falso positivos" y en 2 casos mielogramas "falso negativos," como se comprobó en la operacion.

La exactitud de los mielogramas se computó por el número de decisiones hechas con base en los mielogramas y comprobadas o no, durante la operación.

El mielograma estaba correcto en 85 por ciento de los casos.

El porcentaje de casos en que al radiólogo y el cirujano coincidieron en cuanto a la interpretación de los mielogramas fue 92.

Las indicaciones y contraindicaciones para estudios mielográficos se mencionaron. Se surgieren condiciones específicas y se delineó el procedimiento usado en la serie reportada.

The great physician, Sir William Osler, who made his reputation in the United States and died at Oxford in the Regius Professorship of Medicine, was a famous bibliophile. As an impoverished medical student in Canada he began his collection with a copy of *Religio Medici* by Sir Thomas Browne and that volume was placed in his coffin at his death.

Even more than Bacon but in a very different way, Browne (1605-82) is a figure to conjure with. Profoundly religious, he was dangerously superstitious, at least as far as witches were concerned, and yet he seems to have been more subtly, penetratingly, interested in nature than was Bacon, and did more systematic observation and experiment. He was born in London, studied at Oxford and received his medical training and degree on the continent. Practicing medicine in the little town of Norwich, he kept out of the religious and political storms of the day.

His first book, *Religio Medici*, written for his own private satisfaction was first published without his permission in 1643. His fascinating and weirdly learned treatise on popular errors, *Pseudodoxia Epidemica* was published a few years later, and *Hydriotaphia* or *Urne-Burial*, and *The Garden of Cyrus* in 1658. Inspired by the discovery of some ancient sepulchral urns at Norfolk, Browne set down his wondrous reflections on funeral ceremonies, on immortality and annihilation. The final chapter may well be the most gorgeous prose in the English language.

—*Houston*

Obstetric and Gynecologic Surgery

Prolapse of the Vagina After Hysterectomy

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PROLAPSE of the vagina and of the "remaining cervix" does not seem to be particularly frequent. I, personally, have had but 12 cases within fifteen years, in only 9 of which the patients were operated on. I am of the opinion that only the second and third stages of prolapse, within a certain degree of vulvar protrusion, are important and deserve any special surgical interest, for a slight lowering of the bladder and a moderate swoon of the perineal fundus, causing a sort of first-stage prolapse, are of frequent occurrence in hysterectomized patients and are not important.

The rarity of the condition is due to the fact that multiparity remains the main cause of prolapse, and the lesions that require hysterectomy, as a rule, cause primary or secondary sterility.

On the other hand, vaginal atrophy and infundibular sclerosis of the vaginal fundus are the rule after hysterectomy and are unfavorable to the development of prolapse, since thickened and infiltrated vaginal walls find difficulty in unfolding themselves. This rule, however, is not absolute, especially when the operation has preserved all or part of the ovaries and the presence of normal estrogenic function may therefore be assumed. Of the patients observed, only 2 were aged women. The others had undergone hysterectomy before reaching the age of 40, and in their cases the prolapse had occurred soon, i.e., from one to three years after the initial operation. It has been ascertained in most cases that insufficiency of the perineal fundus due to anterior deliveries was the main cause of prolapse. The insufficiency is not necessarily due to an obstetric rip with apparent rupture of the fourchette; it results mainly from the tearing of the posterior commissures of the levator muscles, which I described in detail at the time of the French gynecologic meeting in 1954. The case that posed the most difficult problem, however, was that of a 45-year-old multipara.

Treatment of vaginal prolapse after hysterectomy is never simple. It is necessary to make a distinction between the prolapse that occurs after subtotal hysterectomy (with or without reservation of the adnexae) and that which occurs after total hysterectomy.

In the first category of cases (subtotal hysterectomy) two sets of circumstances are brought together: a favorable one, in that a utilizable cervical stump is maintained by means of adequate high fixation by the abdominal approach, and an unfavorable one, in that the cervical stump may in certain cases constitute the beginning of the prolapse as well as its aggravation by hypertrophic lengthening.

Of course, ovariectomy in cases of subtotal hysterectomy leads to progressive atrophy of the cervical stump and thus lowers the risk of hypertrophic lengthening. If one keeps as far as possible, how-

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ever, to the highly recommended performance of a conservative operation whenever the condition of the adnexae allows it, preservation of ovarian function will aggravate the risk of hypertrophic lengthening of the cervix; it is no longer the anterior vaginal wall that is lowered—the cervix becomes inserted itself into the vulvar tear, causing it to gape, while the area of the isthmus and the deep scar of the cervix remain at about the same level. Estimation of this lengthening of the cervix is an essential part of the clinical examination in such cases; without it, one will always meet with failure.

In the second category (total hysterectomy) there is no support for the vaginal dome except the fibrocellular scar, which is usually sufficient to prevent prolapse. The highly important lowering of the vaginal walls, however — they are sometimes completely reversed, like the fingers of a glove—remains possible under three conditions:

1. When the greatest pressure is centralized on the axis of the vagina or on the vaginal scar, either by the viscera or by the intraperitoneal liquid output. In these circumstances the acute prolapse is a complication due to the intraperitoneal fluids.

2. When the vaginal walls are primarily thinned and loosened from the cellulomuscular tissue. The main role here is played by multiparity.

3. When the perineal fibromuscular fundus is insufficient, especially when the indispensable obliquity of the perineal angle has been suppressed.

There is a double aspect to the surgical problem in cases of prolapse following hysterectomy:

1. How to treat prolapse when it occurs. Is it possible to prevent prolapse by a modification of the technic of hysterectomy?

In my opinion the surgical indications after subtotal hysterectomy may be summarized as follows:

Clinical study and examination by speculum may show a normal cervical stump, or the cervix may even be atrophied. There is no lowering of the cervix, even when the patient exerts violent abdominal pressure; there is only an unfolding of the anterior vaginal walls, with isolated or associated cystorectocele. These conditions are always of obstetric origin and exist prior to hysterectomy. It is not a question, therefore, of prolapse following hysterectomy, but only of aggravation of a prolapse existing prior to the operation and overlooked. I have had 2 such cases. In this situation a simple colpoperineorraphy seems to be sufficient. It is the only type of case in which a purely muscular operation can be adequate, be it the Manchester, the Crossey Halban or any other technic. If the cervix is normal, I see no reason to amputate it. It has a possible physiologic role in the sexual equilibrium, and if it is preserved the patient will not feel physically diminished as she may feel after an amputation.

In other cases the cervix is only slightly lowered during abdominal pressure. The unfolding of the vaginal walls is little apparent. The cervix, however, is vertically stretched; it takes on the appearance of an elephant's trunk. In this case a greater or lesser colpoperineorraphy or even colpocleisis will bring about no valuable results. As long as the cervix remains, it will insert itself into the different vaginal planes and will cause recurrence of prolapse. The patient with whom I had the greatest trouble was in this category. I made the mistake of performing a tight classic colpoperineorraphy on a multipara, aged 40, who presented a prolapse of this type after hysterectomy, with preservation of the ovaries, for a fibroma. A prolapse occurred soon after, the cervix coming through the vulva less than one year after the operation. A second fail-

ure occurred a few months later, after abdominal fixation of the cervical stump. I obtained lasting success by the simple operation I should have begun with: flat amputation of the cervix by the Bonney technic. In this case, therefore, a satisfactory result was obtained by slight lowering of the vaginal dome, with some unfolding of the vaginal walls, but with a long, slender, conical cervix. In my opinion the method of choice is cervical amputation, depending on the case, with anterior and posterior colpoperineorraphy. This is the triple perineal operation of which Magendie in France has been the chief supporter.

There are cases, finally, in which the vaginal dome is lowered but seems mainly drawn away by the cervical stump. It is the cervix that comes down, carrying along and unfolding the vaginal walls. The cervix is not lengthened; it is short and often thick, inflamed and metritic. An operation by the vaginal approach, in my opinion, would not be sufficient in such a case. Of course, the cervical stump must be stabilized by high abdominal fixation, either by use of the stumps of the round ligaments and the lumbo-ovarian stumps or by direct and solid fixation of the cervical stump in the sheath of the right rectus muscles, which is a simple operation to perform when the prolapse is severe.

It may seem imprudent to leave such a cervix in its place, and many would prefer to perform total instead of subtotal hysterectomy, as it is necessary to reoperate afterward by the abdominal approach. If the cervix is clearly metritic I agree, but if the lesions are unimportant and superficial, i. e., if they heal quickly (within three weeks) in response to superficial electrocoagulation, I am convinced that it is possible to preserve the cervix, the importance of which lies in the fact that it is the best physiologic support of the vagina.

But there is another problem. Ameline, of France, recently insisted upon the danger of creating a depression and an abnormal depth of the Douglas *cul de sac* by drawing the cervix or the cervical stump too high and too far forward. This would create a favorable environment for the pseudohernia of Douglas. For this reason I always perform a Douglas obliteration, after the technic of Marion, at the time of fixation of the cervical stump.

Of course, the extent of either the cystocele or the rectocele may necessitate a complementary perineal operation.

In the same way, for elderly women who do not desire to preserve sexual function, prolapse following hysterectomy justifies an operation after Lefort or a colpocleisis, a simple operation to perform, which I always recommend in such cases.

Of course, high fixation of the cervical stump after total hysterectomy is no longer possible, and total or partial colpocleisis or colpectomy will involve great difficulties in dissection. The absence of cleavage at the level of the vaginal scar, the risk of hurting the ureter in this area, which is so highly modified, anatomically speaking, the absence of support given by the uterine cervix to dissection and cleavage make these operations extremely difficult.

I consider it preferable to perform an abdominal operation in such cases. According to the individual need, I either perform reimplantation on the vaginal scar of a tubo-uterine pedicle or use the round ligament stump. In France, Diamant-Berger proposed an operation with which I am not personally familiar, using an aponeurotic pedicled strip which, coming from the sheath of the right rectus muscle, is fixed upon the vaginal scar under the peritoneum.

In such cases I perform what I consider the best operation, i. e., the Douglas blind-alley obliteration by means of circular

stitches, the last one fixing what is left of the ligaments, round and uterosacral. I recover this zone with vesical peritoneum lifted in the Pestalozza manner to "blind out" the whole Douglas cavity and prevent reversal of the vaginal dome.

As I have stated, the treatment of prolapse following hysterectomy is not simple. It is therefore best to prevent prolapse in the first place. By application of the following principles, this, in my opinion, is possible:

1. Test the real value of the perineum and perform a complementary simple colpoperineorraphy during the hysterectomy if a perineal deficiency brings about a prolapse.

2. Prefer total to subtotal hysterectomy when there is hypertrophic lengthening of the cervix, especially if the ovaries are to be preserved.

3. Fix the cervical stump carefully if subtotal hysterectomy is performed, either by reimplanting the round ligaments on the stump or by performing the excellent Desmarets operation, to keep the tubes and the ovaries in their respective places and reimplant them in the surface of the stump section. This operation is possible in the surgical treatment of fibroma or even of an important infectious lesion of the tubes that does not require ablation. It offers not only excellent fixation, which prevents prolapse, but the possibility of maintaining some menstrual function.

4. In performing total hysterectomy it is still possible to fix the pedicles on the borders of the vaginal scar. It is easier to attend to this fixation during hysterectomy than to do it long afterward, when an obvious prolapse has occurred.

In order to prevent an eventual prolapse, it is useful to stitch the colic region to the bladder, which isolates the pelvis and prevents abdominal pressure on the vaginal dome. Always I operate in this way in case a vaginal drain is used.

SUMMARY

Vaginal prolapse after hysterectomy is provoked by perineal deficiency but not by perineal deficiency alone. When vaginal prolapse is clinically apparent, ordinary perineal operation is rarely sufficient.

In some cases one has either to treat hypertrophic lengthening of the cervix by complementary operation or to treat lowering of the vaginal dome by high abdominal fixation. Obliteration of the *cul de sac* of Douglas, according to the author, is the best way to solve these difficulties.

RIASSUNTO

Il prolasso vaginale, dopo isterectomia, è provocato da una deficienza perineale, ma non solo da essa. Quando il prolasso vaginale è clinicamente manifesto, ben raramente è sufficiente la sola operazione perineale. In alcuni casi o si deve correggere l'allungamento ipertrofico con una operazione o l'abbassamento della cupola vaginale con un fissazione addominale alta.

Secondo l'autore il miglior modo per ovviare a queste difficoltà è quello di obliterare il cavo del Douglas.

ZUSAMMENFASSUNG

Ein nach Gebärmutterresektion auftretender Scheidenvorfall wird durch Schwäche des Dammes aber nicht durch diese allein hervorgerufen. Wenn ein Scheidenvorfall klinisch in Erscheinung tritt, reicht eine gewöhnliche Dammoperation selten zu seiner Behebung aus.

In manchen Fällen muss man entweder die hypertrophische Verlängerung durch einen weiteren Eingriff oder das Sinken des Scheidengewölbes durch hohe abdominale Fixierung behandeln.

Den besten Weg, diese Schwierigkeiten zu beseitigen, sieht der Verfasser in einer Verödung des Douglasschen Raumes.

RESUMEN

El prolapso vaginal post histerectomía es provocado por deficiencia perineal pero no solo por esta causa. Cuando el prolapso vaginal es aparente clinicamente, una operación perineal ordinaria, raras veces es suficiente.

En algunos casos hay que tratar el alargamiento hipertrófico por una operación asociada ó tratar el descenso de la cúpula vaginal por medio de fijacion abdominal alta.

La obliteración del fondo de saco de Douglas, es de acuerdo con el autor, el mejor medio para resolver estas dificultades.

RÉSUMÉ

Le prolapsus vaginal après hystérectomie est provoqué par une déficience du périnée, mais celle-ci n'en pas la seule cause. Lorsque le prolapsus vaginal est cliniquement apparent, l'opération périnéale ordinaire est rarement suffisante.

Dans certains cas il faut, soit traiter l'hypertrophie au moyen d'une intervention associée, soit traiter la ptose du dôme vaginal par un fixation haute.

L'oblitération de la cavité de Douglas est, selon l'auteur, le meilleur moyen de résoudre ces difficultés.

There is on record the overwhelming elation felt by scientists at the moment of discovery, elation of a kind which only a scientist can feel and science alone can evoke in him. Kepler testified to it in his *DeHarmonice Mundi*, published in 1916, in which he announced the discovery of his "Third Law," connecting planetary periods and distances. He writes ". . . nothing holds me; I will indulge in my sacred fury; I will taunt mankind with the candid confession that I have stolen the golden vases of the Egyptians, in order to build of them a tabernacle to my God, far indeed from the bounds of Egypt. If you can forgive me, I shall rejoice; if you are angry, I shall bear it; the die is cast, the book is written, whether to be read now or by posterity I care not: it may wait a hundred years for its reader, if God himself has waited six thousand years for a man to contemplate His work. . . ." The excitement of the scientist making a discovery is an *intellectual* passion, telling that something is *intellectually* precious and, more particularly, that it is *precious to science.* And this affirmation forms part of science.

—*Polanyi*

The Obstetric Importance of the "Long Pelvis"

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IN studying the structural abnormalities of the bony pelvis in textbooks on Obstetrics, one notes that the rachitic respectively flat pelvis and the generally contracted pelvis are the most important deformities. The obliquely and transversely contracted pelvis is not as common a cause of complications.

In 1949 one of us (Kirchhoff) published a monograph entitled *The Long Pelvis* and added this formerly neglected variety of pelvic deformity to the types already generally known and recognizable by external inspection. For some time it had been well known to anatomists as "assimilation pelvis," though it is surprising that up to that time obstetricians had not paid adequate attention to it. In clinical studies comprising over 200 cases the obstetric importance of this type of pelvis was convincingly explained (Kirchhoff, 1949). Therefore, knowledge of hitherto inexplicable obstetric complications in the sense of a standstill or of an unclear pathologic type of delivery was enlarged.

The functional importance of an assimilation pelvis can be interpreted roentgenologically only in connection with the clinical picture.

"Assimilation" refers to an anatomically conditioned peculiarity of the vertebral column. One vertebra takes the place of a vertebra of an adjacent part of the vertebral column, and resembles it. Obstetricians are naturally especially interested in abnormalities of the lumbosacral region in its relation to a low or high assimilation pelvis. The question of the functional importance of the vertebra concerned is of the utmost importance; i e., whether or not this vertebra already belongs to the pelvis and is thereby decisively influencing the shape of the pelvic inlet. An answer to this question can be expertly given by a lateral roentgenogram taken by the Guthmann method. Only in this way is it possible to see whether the "lumbosacral transitional vertebra" and the sacrum are forming an important functional obstacle by limiting the birth canal. The degree of assimilation recognizable in the anteroposterior roentgenogram in no way influences the position of the transitional vertebra; the two are entirely independent of each other. The last lumbar vertebra may belong functionally to the sacrum without showing any signs of assimilation ("functional high assimilation"). Kirchhoff's detailed obstetric-clinical and informative roentgenologic studies resulted in a typical and reiterating syndrome. If the transitional vertebra tends more toward the sacrum, visible by the greater inclination of its anterior surface toward the symphysis, one finds a remarkable elongation of the bony birth canal by one vertebral body, i. e., practically by 2 to 3 cm. The pelvis becomes too long. This characteristic, which has functional importance, led to the conception of the "long pelvis." There are, however, other noteworthy peculiarities.

If another vertebra is added to the sacrum, the promontory is elevated (high promontory); the plane of the pelvic inlet is correspondingly tilted, and the pelvic inlet changes its shape. In these cases the

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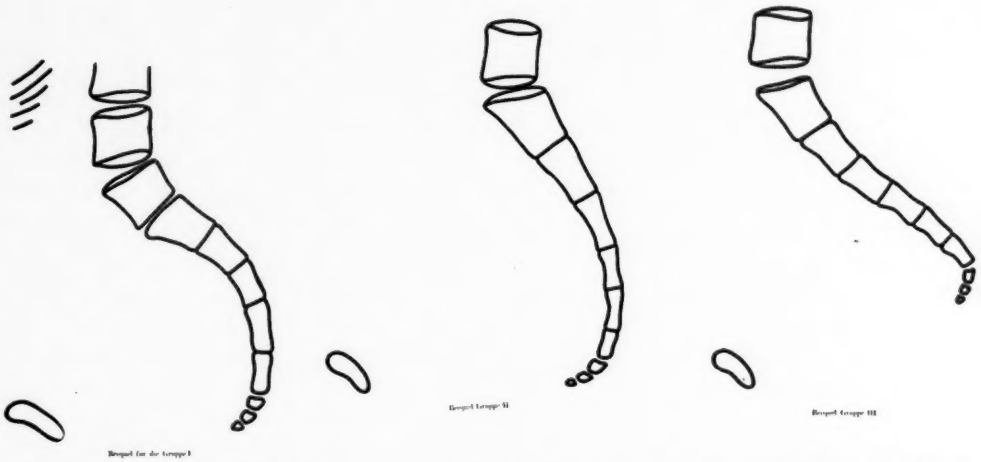
measurement of the conjugata vera (conjugata vera I) is enlarged in comparison to the norm. One who is not informed about this pelvic anomaly may be easily deceived, and a missed diagnosis may have severe consequences. In reality the "true" obstetrical conjugate (conjugata vera II), i. e., the really narrowest straight diameter of the birth canal runs at a level of one or even two vertebral bodies lower than the promontory. In such cases one is dealing with a "double promontory."

The peculiarities discussed up to now result from the "transitional vertebra" with its sacral tendency, and refer exclusively to the pelvic inlet. Speaking of the "long pelvis," there are also other interesting points concerning the lower parts of the birth canal, which are the consequence of the shape and structure of the os sacrum. In studying roentgenograms of the "long pelvis," one observes besides a more erect position, a more or less express flattening out of the sacral concavity, which influences the mechanism of labor by stretching the sacrum and thereby further elongating the already long bony birth canal. In typical cases one finds a cylindric bony birth canal, the straight diameters of the planes of which scarcely differ at all. This structural deviation, combined with the transitional vertebra, explains the numerous obstetric complications that may arise if one is dealing with a long pelvis, with the oval-shaped, transversely contracted superior straight playing an additional part.

Clinical Data on the Long Pelvis (Winter)

	Leipzig and Kiel		*Lubeck*		*Material for Comparison*
	Number of Cases	%	*Number of Cases*	%	*Leipzig 1938/39*
Total number of cases	212		56		8,400
Spontaneous deliveries	109	51.5	35	62.5	85 %
Cesarean sections	47	22.2	15	26.8	2.7%
Forceps deliveries	39	18.4	5	8.9	6.2%
Perforations	9	4.2	2		0.5%
Extractions	8	3.7	—		
Brow and face presentations	9	4.2	2		1.5%
Breech presentations	13	6.2	7	12.5	3.6%
Positio occipitalis pubica et sacralis	4		8	14.3	
Occipitoposterior presentations			17	30.4	
Maternal mortality	5	2.3	—		0.4%
Infant mortality	15	7.1	2		5.5%
Duration of labor, hours	24		19		

In this table the data on the long pelvis in cases observed at the Women's Hospital of the Universities of Leipzig and Kiel (Kirchhoff) are compared with the results of corresponding examinations during Kirchhoff's directorship of the Municipal Maternity Hospital of Lübeck. An evaluation of these data can be made by comparing them with the total number of obstetrical patients delivered at the Women's Hospital of the University of Leipzig during 1938 and 1939. Note that the deductions from the previous investigations in Leipzig and Kiel exert a noticeable influence on the figures from Lübeck: The number of spontaneous deliveries is increased, maternal and infant mortality are decreased. The number of occipitoposterior presentations is remarkably high.



Left, example of "long pelvis," Type 1. Fifth lumbar vertebra has expressively sacral tendency. Double promontory easily recognizable. Plane of superior straight is steep. Smallest diameter below promontory 1. External measurements within normal limits. *Center,* example of "long pelvis," Type 2. High promontory, steep pelvic inlet. Only one promontory, sacrum elongated and flattened, sacral concavity still existing. *Right,* example of "long pelvis," Type 3. Promontory is nearly straight above symphysis. Sacrum totally straightened, forming a "one-way street" without curves. Smallest diameter far below promontory. Disproportion in spite of long conjugata vera.

It is interesting that, at the same time, American authors (Caldwell and Moloy), studying the pelvis, also came to conclusions which to a great extent are in accordance with those aforedescribed. They distinguish four different types of pelvis. Their "anthropoid" type corresponds with the special pelvic type described by myself. They also stressed the length of the pelvis and the fact that the pelvic inlet appears, anteroposteriorly, more or less like an oval. They also pointed out the high frequency of complications *sub partu.*

I myself distinguish three different types of long pelvis, which differ in their obstetric importance.

Type 1 (see illustration, A).—Assimilation-transitional pelvis: Only the lumbosacral transitional vertebra with sacral character has functional importance: high promontory, double promontory, false conjugata vera I. The birth canal is elongated, the plane of the superior straight diameter is steep.

Type 2 (see illustration, B).—Assimilation pelvis with unchanged shape of sacrum (6 sacral vertebrae); assimilation vertebra belongs anatomically and functionally to the normally shaped sacrum. Only one promontory forms the narrowest diameter. There is certain flattening out of the sacral concavity. The pelvis is elongated with a steep pelvic inlet and a high promontory.

Type 3 A (see illustration, C).—Assimilation-canal pelvis with 6 sacral vertebrae; the most outstanding type of long pelvis. Additional elongation due to stretching of the sacrum, missing sacral concavity. Promontory remarkably high; very steep pelvic inlet. Length of conjugata vera I above average, "true" obstetric conjugata vera (conjugata vera II) situated between the first and second sacral vertebrae, often shortened.

Type 3 B.—Canal pelvis with 5 sacral vertebrae and with a probable but not proved assimilation: Canal shape of pelvis

leads to a certain elongation, despite regular number of vertebrae. Otherwise no great difference from Type 3 *A*.

To sum up, the following characteristics of the long pelvis are known to be "troublemakers" of obstetric importance:

(1) elongation of the bony birth canal;

(2) formation of a "double promontory";

(3) A cylindrically shaped birth canal, and a

(4) pelvic inlet appearing anteroposteriorly like an oval.

In a high percentage of cases these "troublemakers" lead to deviations from the normal course of delivery. The high promontory with the thereby conditioned steep plane of the superior staight diameter prevents optimal presentation of the presenting part. In normal labor the axial pressure of the fetus is usually directed vertically toward the plane of the superior straight diameter. The high and prominent promontory, no longer serving as a splint, induces the head to hit the pelvic inlet at an acute angle, thereby producing a posterior asynclitism. The anterior parietal bone rises above the symphysis (Zangemeister, positive), and in spite of normal measurements there seems to be an initially inexplicable cephalopelvic disproportion. As the pelvic inlet of the long pelvis often resembles an oval posteriorly, one frequently encounters two other complications, the positio occipitalis pubica or sacralis and the persistent occipitoposterior position. Beside these abnormalities of position one observes a higher number of other abnormal presentations—breech, transverse, brow and face—the incidence of which is above the average. The presence of a smallest diameter *below* the promontory (Types 1 and 3) prevents the engagement of the fetal head and leads to a standstill of labor without perceptible cause.

Additionally a good number of midpelvic and outlet complications of labor are due to a long pelvis, especially of Type 3. The stretched straight sacrum combined with the lacking "tolerance space" forms an obstacle to the normal course of the second phase of labor, i. e., the engagement, bending and rotating of the presenting fetal part. In such cases the result is a standstill of labor; one observes a midpelvic transverse arrest or deflection of the fetal head, or meets with inexplicable outlet difficulties, the persistent occipitoposterior positions being a frequent abnormality. The bony birth canal, which is too long and unfavorable to the progress of labor, as well as a definite tendency toward uterine inertia in a woman with a long pelvis, results in prolonged labor, exhaustion of the mother and fetal distress.

The complications described, which should not be minimized, stress the importance of this type of pelvis and point to the dangers menacing the mother as well as the infant. Disturbances in connection with the pelvic inlet deserve special attention.

If one observes abnormalities of position and presentation, or standstill of labor with arrest of the fetal head above or within the superior straight diameter, if there is an inexplicable cephalopelvic disproportion, and if one does not succeed in turning the patient to one side according to the prevalent rules, one must think in time of the long pelvis and control one's thinking and therapeutic procedures by taking a lateral roentgenogram. Only half of patients all with long pelvises will deliver spontaneously (Kirchhoff). Cesarean section is necessary for about 25 per cent, the rest have to be delivered by operative procedures (forceps, perforation). H. Winter's observations were similar. He had available more recent material for comparison and observed, additionally, a decrease of maternal and fetal mortality,

which he is justified in considering a pleasing result of the practical benefits derived from the new-found knowledge of the long pelvis (see table).

During the past few years a number of others—H. Walter, H. O. Kleine, Fochem, Froewis and Narik—have written about this type of assimilation pelvis. All of these authors confirmed the importance of the newly described pelvic abnormality by observations of their own, and were unanimous in pointing to the high frequency of operative complications. H. O. Kleine stressed the peculiarities and practical importance of the conjugata vera and the conjugata diagonalis. In the newest edition of his *Textbook of Obstetrics* H. Martius also added this special pelvic type to the list of abnormalities of the bony pelvis, thereby introducing it into the field of clinical instruction.

In what percentage of cases does one encounter a long pelvis? This question can be answered only indirectly and with great reservation. It may be assumed that, taking all pathologic types of pelvis together, the percentage of the long pelvis is about 40 per cent and therefore equal to the incidence of the rachitic pelvis.

With respect to the genesis of the long pelvis, the results of orienting studies on postnatal pelvic development implied that this type of pelvis is caused by a general, apparently hormonally conditioned, arrest of development. The observation that a great percentage of the patients suffer from an ovarian insufficiency speaks in favor of this explanation. Examinations of relatives made it certain that hereditary factors also play a certain part in producing variations in the different segments of the vertebral column.

There is no doubt that the long pelvis, as a variety of the assimilation pelvis, has a special importance. Knowledge of this type of pelvis with its different trouble points and with the serious complications arising therefrom, should be a part of every obstetrician's training. It represents a recent theoretic achievement of practical importance.

SUMMARY

In addition to the hitherto well-known anomalies of structure of the bony pelvis there is the "Assimilationsbecken," which has some practical importance. This is called by the author "long pelvis." It can cause serious complications, which knowlledge of its nature and existence enables one to foresee and prevent. The anomaly is not uncommon and is best diagnosed by means of lateral roentgenogram.

RIASSUNTO

Accanto alle già note anomalie del bacino osseo, anche al "bacino di assimilazione" di Kirchhoff, detto anche "bacino lungo," spetta un'importanza praticamente notevole. Molteplici fenomeni di disturbo possono causare gravi complicazioni, che però sono evitabili ove si conosca questa forma di bacino che si presenta tutt'altro che raramente. La diagnosi è finora possibile solo attraverso i raggi, per mezzo di una radiografia laterale.

ZUSAMMENFASSUNG

Neben den bisher bekannten Bauanomalien des knöchernen Beckens kommt dem Assimilationsbecken, von Kirchhoff auch als "Langes Becken" bezeichnet, eine praktisch wichtige Bedeutung zu. Mehrfache Störungsmomente können schwerwiegende Komplikationen bedingen, die aber bei Kenntnis dieser keineswegs selten auftretenden Beckenform vermeidbar sind. Die Diagnose ist bisher nur röntgenologisch durch eine seitliche Aufnahme zu stellen.

RÉSUMÉ

Apart des anomalies de la structure pelvienne déjà connues le bassin d'assimilation, désigné "Langes Becken" (bassin long) par Kirchhoff, est d'importance practique. Cette formation du bassin que n'est pas rare du tout, peut causer des troubles nombreux et des complications sérieux, qu'ou peut eviter, si elle est connue. Jusqu'à présent la diagnose est seulement possible radiologiquement par une radiographie latérale.

SUMARIO

Em adiccão às anomalias de estructura da pelvis ossea, até aqui bem conhecida, existe a chamada "assimilacao pelvica," a qual tem alguma importancia practica. Esta è denominada pelo autor "long pelvis" ou pelvis longa. Esta anomalia póde causar sèrias complicacoès, mas o conhecimento de sua natureza e existencia habilita o ginecologista e obstetra a prevêlas e preveni-las. Esta anomalia não è rara e è melhor diagnosticada por meio de roentgenogramas lateraes.

RESUMEN

Además de las ya bien conocidas anomalías de estructura de la pelvis ósea, existe la "pelvis de asimilación," que tiene alguna importancia práctica. Esta es llamada "pelvis larga" por el autor. Puede causar serias complicaciones que pueden ser previstas y evitadas por el ginecólogo y el obstetra que tengan conocimiento de su existencia y naturaleza. Esta anomalía no es rara y se diagnostica mejor por medio de radiografías laterales.

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What sculpture is to a block of marble, education is to the soul.

—*Addison*

Education is an ornament in prosperity and a refuge in adversity.

—*Aristotle*

Education makes people easy to lead, but difficult to drive; easy to govern, but impossible to enslave.

—*Lord Brougham*

The secret of education lies in respecting the pupil.

—*Emerson*

Ophthalmologic Surgery

Hypotony Following an Intraocular Surgical Procedure

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HYPOTONY is a rather consistent occurrence after intraocular surgical operations, especially those performed for cataract or glaucoma. In most instances hypotony is not a cause for alarm, as normal intraocular pressure eventually is reestablished with no permanent visual loss. Complications do result in a small percentage of cases, especially when hypotony is accompanied by prolonged flattening of the anterior chamber. The hypotony resulting from loss of vitreous is not included in this article.

The frequency with which hypotony follows the extraction of cataract has been amply demonstrated by Hilding,[1] who observed it so regularly after the twelfth day that its occurrence is now considered the rule rather than the exception. I agree with Hilding[1] that this sequence of events is frequent, whether there is a flattened anterior chamber or not. The same holds true following operations for intraocular glaucoma. Postoperative checks of intraocular pressure show that hypotony frequently lasts for three or four weeks. In the absence of prolonged flattening of the anterior chamber, the intraocular pressure will return to normal limits without any permanent damage to the eye.

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Hilding[1] postulated that the trauma, accompanied by edema or hemorrhage or both, that is incidental to the extraction of a cataract causes a disturbance of the electrical potentials between the stroma and the epithelium. As a result, there is interference with the production of aqueous, and the rate of outflow of aqueous is reduced, owing to general congestion. Bellows and his co-workers[2] suggested that a pronounced diminution of the flow of aqueous may be an important cause of prolonged flattening of the anterior chamber. They expressed the opinion that, because of the pressure gradient between the posterior and the anterior chamber, a transient lack of the aqueous causes the vitreous to be drawn firmly against the iris, thus obstructing the free passage of aqeuous from the posterior into the anterior chamber. As the aqueous is thus prevented from entering the anterior chamber, the pressure gradient increases. This places the hyaloid membrane and the vitreous still more firmly against the iris until complete obstruction occurs. With this pupillary block, the back pressure in the posterior segment interferes with uveal circulation, which in turn results in diminished aqueous formation.

I agree with Hilding[1] and Bellows[2] that diminished formation of aqueous is a cause of postoperative hypotony. In some instances, perhaps, both theories of postoperative hypotony are at least partially

applicable. Hypotony following an operation for cataract is much less frequent when the wounds are adequately sutured than when they are not. Two corneoscleral sutures should not be considered adequate. An early leak, even though its outlet closes spontaneously, would precipitate the train of events aforedescribed.

Clinical and pathologic observations of eyes with postoperative hypotony suggest that the diminished formation of aqueous is a prime cause of the hypotony. A constant finding in eyes soon after intraocular surgical operations is edema of all of the intraocular tissues, as well as widespread hemorrhages. Contrary to the report of Dellaporta,[3] papilledema, which is discernible ophthalmoscopically, is observed not infrequently in eyes with hypotony following surgical operations for both cataract and glaucoma. On several occasions I have seen peripapillary retinal hemorrhages after extraction of cataract, which is contrary to Dellaporta's report that they do not occur. In 1 instance considerable papilledema, accompanied by hemorrhages, was noted on completion of extraction of cataract.

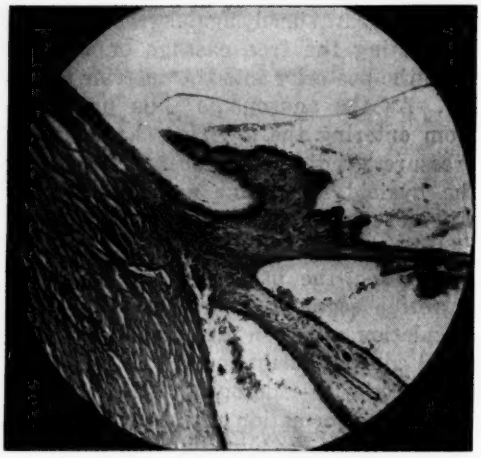

Fig. 1.—Hypotony of twenty-four hours' duration. Rabbit eye shows hemorrhage in base of ciliary body opposite wound.

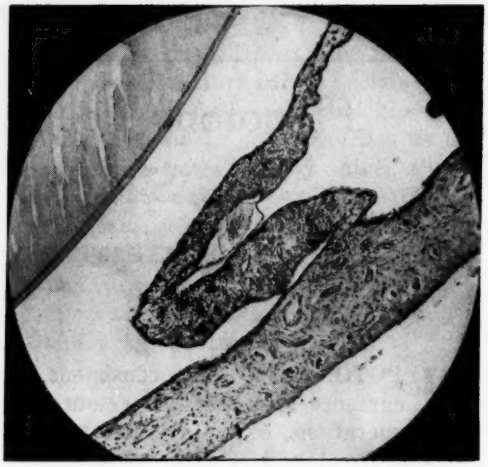

Fig. 2.—Hypotony of ninety-six hours' duration. Rabbit eye shows congestion and edema of ciliary body.

Kirby[4] stated that he has frequently seen macular edema after operations for glaucoma, and that he considers it likely to follow any opening of the eye.

Figures 1 and 2 are of rabbits' eyes in which the corneas were trephined, without disturbance of the irides, to produce hypotony. Trauma was avoided as much as possible in order to minimize the effect of trauma on the intraocular structures. All sections show edema. Figures 1 and 2 demonstrate hemorrhages, and Figures 3 and 4 demonstrate congestion of the intraocular tissues. In my opinion the hemorrhages, edema and congestion of the intraocular tissues are primarily due to the sudden lowering of intraocular pressure. Normally the intraocular (vascular) pressure is adjusted to an intraocular pressure that is relatively constant and not too much lower than the intravascular pressure. The sudden loss of the intraocular pressure would upset this delicate balance, causing transudation of fluid, congestion and hemorrhages. The choroidal detachment observed so frequently in eyes with postoperative hypotony is probably due to

Fig. 3.—Hypotony of forty-eight hours' duration. Rabbit eye shows congestion and edema of ciliary body.

this transudation of fluid.

Heath[5] listed many pathologic changes that occur in eyes with hypotony. The symptoms of hypotony following an intraocular surgical procedure are primarily those of irritation. Lacrimation is frequent. The eyeball is injected, and this condition often is accompanied by edema of the eyelids. The corrected vision is always subnormal. The disappointing vision one occasionally obtains three to five weeks after extraction of a cataract may well be attributed to the fact that the intraocular pressure is still subnormal.

The flattening of the anterior chamber sometimes associated with hypotony may become a serious matter if allowed to persist too long. Kronfeld[6] noted that absence or near-absence of the anterior chamber occurred in 11 per cent of 749 cases of extraction of uncomplicated cataract. He concluded that delayed or disturbed healing of the operative wound is the principal cause of delayed restoration of the chamber.

Chandler[7] strongly emphasized the importance of a tight closure of the wound with scleral sutures when doing a peripheral iridectomy for narrow-angle glaucoma. Barkan[8] described a method of peripheral iridectomy for narrow angle glaucoma that insures retention of the chamber and prevents later leakage from the wound. In Barkan's technic,[8] not only is the possibility of synechia at the angle minimized because the anterior chamber is retained but hypotony, with its potential ill effects, is prevented. Hypotony in cases of narrow-angle (closed angle) glaucoma is especially undesirable, assuming that the resulting pathologic changes in the ciliary body and the iris cause diminution of aqueous formation. The result of this would be prolonged flattening of the anterior chamber with further adhesions at the angle. In my own opinion, the lack of aqueous formation rather than a leaking wound only is the cause of prolonged flattening of the anterior chamber after an iridectomy for narrow-angle glaucoma, or that at least it is aggravated by this lack.

What is the cause of flattening of the anterior chamber after extraction of cataract? The eyes are soft, but the pressure in most eyes is subnormal for many days

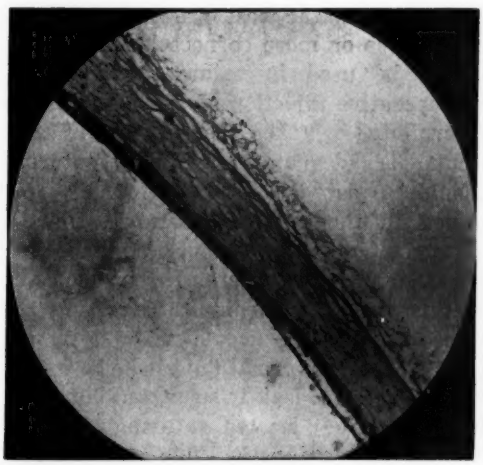

Fig. 4.—Hypotony of twenty-four hours' duration. Rabbit eye shows congestion of choroid.

after a cataract has been extracted. In an eye with a leaking wound, one might expect the iris and the anterior face of the vitreous to move forward, as the pressure gradient would be the least anterior at the site of the leak. Not all eyes with leaking wounds, however, have flattened anterior chambers. In many patients a leaking wound cannot be demonstrated, even though a flattened anterior chamber is present. The condition of the anterior face of the vitreous may be the answer, at least in some instances. If the hyaloid membrane were intact, the iris and the anterior face of the vitreous could come forward together, and a flattened anterior chamber would result. If the hyaloid membrane were not intact, the vitreous could easily herniate through the pupil, equalizing the pressure in the anterior and posterior chambers and retaining the anterior chamber. As was ably pointed out by Chandler and Johnson,[9] flattening of the anterior chamber due to pupillary block can undoubtedly occur.

Correction of hypotony following an intraocular surgical procedure is confined almost exclusively to eyes with flattened anterior chambers. Adequate suturing of the wound is the best preventive measure. Three or more corneoscleral sutures should be used in cataract extraction. Postoperative injection of air is useful in determining whether the suturing of the wound is adequate. Additional sutures should be placed if air is not readily retained in the anterior chamber. Immediately after a cataract operation, the intraocular pressure is zero. Injection of air at this time would raise the pressure to some extent. This would allow a more rapid return to normal fluid balance within the eye. If a leak is suspected but cannot be definitely located, suturing a Kuhnt (Van Lint) conjunctival flap over the upper half of the cornea is effective. It is advisable to cauterize lightly or to freshen the wound before bringing the flap down. If the anterior chamber is flattened, air should be injected at the conclusion of the repair.

A significant number of eyes with flattened anterior chambers will respond to a maximum dilation with 10 per cent solution of Phenyleprine (neosynepherine hydrochloride), followed by maximum miosis with 0.1 isoflurophate (Floropryl) in eyes with pupillary block. This treatment has the theoretic advantage of preventing and possibly breaking anterior synechie. In many eyes with flattened anterior chambers, however, the reaction of the iris is minimal after the use of either mydriatics or miotics.

Injection of air into the anterior chamber is usually effective in correcting a flattened anterior chamber after extraction of cataract. Kronfeld[6] suggested that the beneficial effect of the injection of air may be attributed to the fact that the air completely or partially blocks a leaking wound. This blockage of a leaking wound by air is possible, but the injection of air is certainly beneficial to most eyes with flattened anterior chambers without a demonstrable leaking wound or after a leaking wound obviously has been repaired adequately. Restoration of the intraocular pressure by the injection of air may occur, allowing the structure having to do with aqueous formation to function under more nearly normal conditions. In my experience, release of the suprachoroidal fluid (posterior sclerectomy), in addition to an injection of air into the anterior chamber, has seldom seemed necessary.

Pupillary block should be kept in mind where there is a shallow anterior chamber in a moderately inflamed eye after a round pupil cataract extraction. A posterior synechia is responsible for the pupillary block. The intraocular pressure is usually normal or above normal in spite of a shallow anterior chamber. An anterior syne-

chia forms very quickly and will always result in secondary glaucoma unless the condition is recognized and corrected. A small needle knife opening through the iris is sufficient.

The use of Diamox in flattened anterior chambers, as recommended by Agarwal and his associates[10] has not been effective, but I have not tried this method of treatment in many cases.

In cases of flattened anterior chambers, Armstrong[11] has recommended a few drops of plasma over the incision, and the addition of 1 or 2 drops of "Thrombin, Topical" solution (1,000 units per milliliter). The eye is left open for one to two minutes to allow the clot to become firm; the upper lid then is lifted gently over it and left undisturbed for twenty-four hours.

SUMMARY

Hypotony of several days' to several weeks' duration following an intraocular surgical procedure is a consistent occurrence. The hypotony, in most instances, will disappear spontaneously without permanent damage unless there are complicating factors, such as a flattened anterior chamber.

Apparently the sudden loss of intraocular pressure that occurs with the opening of an eyeball causes transudation of fluid, congestion and hemorrhages. This occurs because the intravascular pressure within the eye remains normal as the intraocular pressure drops to zero.

The diminution of aqueous formation is a major cause of postoperative hypotony and is due for the most part to the edema, congestion and hemorrhages that occur within the ciliary body and the iris. A major factor in prolonged flattening of the anterior chamber is probably the result of this diminution of aqueous formation. This applies especially when a demonstrable leak cannot be demonstrated or when no pupillary block is present.

RÉSUMÉ

Les opérations chirurgicales intra-ocularies sont fréquement suivies d'un état d'hypotonie de plusieurs jours à plusieurs semaines; celui-ci disparaîtra spontanément dans la plupart des cas sans laisser de lésion permanente, à moins de complications, tel—par exemple l'aplatissement de la chambre antérieure.

La baisse soudaine de la pression intra-oculaire au moment de l'incision du globe oculaire, provoque apparemment une transsudation de liquide, ainsi que de la congestion et des hémorragies, dues au fait que la pression intravasculaire de l'oeil reste normale, alors que la pression intra-oculaire tombe à O.

La diminution de la formation d'humeur aqueuse est une des principales cause d'hypotonie post-opératoire; elle est, en majeure partie, due à l'oedème, à la congestion et aux hémorragies se produisant à l'intérieur du corps ciliaire et de l'iris. Un des facteurs principaux de l'aplatissement prolongé de la chambre antérieure est probablement la conséquence de la diminution de la formation de liquide.

RIASSUNTO

Dopo gli interventi endooculari l'ipotonia è una eventualità pressochè costante per periodi di durata variabile. In molti casi scompare spontaneamente senza lasciare danni definitivi, a meno che non vi siano altre complicazioni come il collasso della camera anteriore.

La perdita improvvisa della pressione endooculare che sit verifica con l'apertura dell'occhio causa trasudamento di liquido, congestione ed emorragie. Questo avviene poichè la pressione intravasale rimane normale mentre quella intraoculare è caduta a zero.

La causa principale dell'ipotonia è rappresentata dalla diminuita formazione di acqueo ed è causata in gran parte dall'edema, dalla congestione e dalle emorragie che si determinano nel corpo ciliare e nell'iride. Un altro fattore importante dell'appiattimento della camera anteriore è il persistere nella diminuzione della produzione di umor acqueo. Questa vale quando non vi sia una perdita dimostrabile o quando non vi sia un blocco pupillare.

RESUMEN

La hipotomía de varios días ó varias semanas de duración después de una operación intraocular es de incidencia frecuente. La hipotonía, en la mayor parte de casos, desaparece aspontaneamente sin dejar secuelas, salvo que hayan complicaciones, tales como aplanamiento de la cámara anterior.

Aparentemente la pérdida súbita de la presión intraocular que ocurre con la abertura del globo ocular, causa transudación de líquido, congestión y hemorragias. Esto sucede porque la presión intravascular dentro del ojo sigue normal mientras la presión intraocular cae a cero.

La disminución de formación acuosa es una causa mayor de hipotonía postoperatoria y se debe principalmente al edema, congestión y hemorragia que ocurren dentro del cuerpo ciliar y el iris. Un factor mayor en el aplanamiento Omadero de la cámara anterior, es probablemente el resultado de la disminución de formación de acuosa. Esto es cierto especialmente cuando no se puede demostrar una salida ó cuando no hay bloque pupilar.

SUMARIO

A hipotonia que se segue os métodos cirúrgicos intra-oculares, por varios dias ou semanas, é uma acontecimento constante. Essa situação desaparece expontaneamente, em muitos casos, sem deixar sequelas, a menos que existam complicações tais como achatamento da camara anterior.

A perda súbita de pressão intra-ocular que ocorre com a abertura do globo ocular causa transsudação de líquido, congestão e hemorragia. Isto acontece porque a pressão intra-vascular dentro do ôlho permanece normal emquanto a a pressão intraocular cai à zero.

A diminuição da formação aquósa é a maior causa de hipotonia pós-operatória e é devida, em grande parte ao edema, congestão e hemorragia que ocorrem den tro do corpo ciliar e da íris. O fator mais importante no achatamento prolongado da camara anterior é, provavelmente, o resultado da diminuição da formação aquósa. Isto acontece quando não pode ser evidenciada uma perda líquida ou quando há ausência de bloqueio papilar.

ZUSAMMENFASSUNG

Das Auftreten eines intraokulären Unterdrucks, der mehrere Tage bis mehrere Wochen nach einem chirurgischen Eingriff innerhalb des Auges dauern kann, gehört zu den ständigen Vorkommnissen. In den meisten Fällen verschwindet der Unterdruck von selbst, ohne eine dauernde Schädigung zu hinterlassen, es sei denn dass komplizierende Umstände wie eine abgeflachte vordere Kammer vorliegen.

Offenbar verursacht der während der Eröffnung des Augapfels plötzlich eintretende Verlust des intraokulären Druckes eine Transsudation von Flüssigkeit, Stauung und Blutungen. Das ist darauf zurückzuführen, dass der Druck innerhalb der Gefässe im Augapfel normal bleibt, während der intraokulare Druck auf den Nullpumkt absinkt.

Die Verminderung der Augenwasserbildung ist eine wesentliche Ursache des postoperativen Sinkens des intraokulären

Druckes und beruht grösstenteils auf dem Ödem, der Stauung und den Blutungen, die im Ziliarkörper und in der Iris entstehen. Das Resultat dieser Verminderung der Wasserbildung spielt wahrscheinlich eine erhebliche Rolle zur Entstehung einer anhaltenden Abflachung der vorderen Kammer. Dies trifft besonders dann zu, wenn sich ein Riss nicht nachweisen lässt oder keine Blockierung der Pupille besteht.

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Let him who is capable of thinking for himself and of conceiving noble thoughts adopt, if he can, the manner and the stateliness of the great masters. All the riches of expression belong by right to those who know where to bestow them.

Nor should we fear to repeat an old truth when we are able to give it more force by a better way of saying it, or to link it to another truth that will illuminate it, and so construct a whole body of argument. It is the characteristic of inventive wits that they grasp the connection between things and know how to bring them together; and old discoveries belong less to their first authors than to those who make them useful.

—*Vauvenargues*

Orthopedic Surgery

Fibrosarcoma Following Single Trauma

Report of a Case

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THIS report of yet another case in which a malignant tumor appeared at the site of an earlier injury can be justified only because the entire subject has been one of voluminous discussion and marked disagreement.

REPORT OF CASE

A white man aged 24 struck his left hand on a guard rail at work on April 24, 1954, while loosening a nut wrench. The injury was moderately severe, occurring over the dorsum of the hand between the first and second metacarpals. It caused soreness "like a bone bruise," which lasted a few days and was followed in about ten days by numbness of the thumb, index and middle fingers and "a tight feeling" over the palmar aspect of the third metacarpal. The patient then went to a physician (May 13, 1954). A diagnosis of injury of the left median nerve was made, and hot soaks and protection of the hand were advised. On August 23, 1954, after several visits, it was noted that the patient had little difficulty, although tingling could be produced by percussion over the median nerve, and no motor weakness or sensory low could be demonstrated. The patient was in a new job; he did not have to use his hand for heavy work and failed to keep subsequent appointments. On June 9, 1955, however, I examined this patient because what had been a "pinching, burning sensation" over the radial and volar aspects of the middle finger, the volar aspect of the index finger, and the volar ulnar aspect of the thumb had increased in the past few days; it included the entire thumb and its severity had increased. On gripping hard, he had noticed "shooting, burning" pain over the lateral thenar eminence for the past few days, and, whereas varying the hand's position had formerly afforded relief, this was no longer the case.

The past history included no known exposure to a carcinogen. On physical examination, a point of moderate tenderness was noted over the proximal end of the proximal palmar crease at the distal end of the transverse carpal ligament, with considerable radiation of pain to the radial aspects of the thumb and middle finger. All motions of fingers and thumb were intact, and there was no atrophy or abnormality of color, pulse or temperature. Sensation to pinprick revealed minimal decrease over the volar aspect of the index finger, but marked decrease over the volar aspect of the thumb, the radial aspect of the volar aspect of the middle finger and the dorsum of the distal two phalanges of the middle finger. Grip, although noticeably weakened, caused pain along the radial aspect of the thenar eminence and the thumb. Although a pea-sized, painless ill-defined nodule was palpated over the juncture of the proximal and middle thirds of the proximal palmar crease, this could not be detected on subsequent examinations. The impression was that of a carpal compression syndrome,[39, 40] and on July 25 the transverse carpal ligament was exposed and divided. Structures beneath the ligament seemed normal. On October 10 the patient was seen in consultation with two other orthopedists. He complained of a "tight feeling" in the knuckles and a "pinching feeling" in the middle finger and, to a lesser extent, in the index. He had returned to work a week after his operation. The palm had been less tender, but the thumb,

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index and middle fingers still tingled when struck. The nodule, which had been extremely tender prior to the operation, had "disappeared." Positional changes that caused cramping in the hand, noticed before the operation, had also disappeared. The tips of the thumb, index and middle fingers were still sensitive; there was an occasional "drawing" in the wrist, but the "burning" in the fingers had improved to a pronounced degree. The patient considered himself improved. On physical examination, the significant signs were hypesthesia over the proximal volar portions of the index and ring fingers and hypesthesia distal to this, with normal sensation over the thenar eminence, but hypesthesia over the midvolar surfaces of the phalanges of the thumb. The scar was well healed, nonadherent and just ulnarwards to the thenar crease, extending distally to the midpalm. Some increased weakness in the grip of the left hand was noted, and there was some dryness of the index and middle fingers. No abnormal masses were palpated.

A month after this consultation an ill-defined, pea-sized nodule was observed over the midportion of the scar, and this was judged to be induration about the scar. Pain and tenderness recurred along sensory branches of the median nerve, frequently during the day, and sensory loss in the tips of the thumb, index and middle fingers had become pronounced. A month later the small nodule had become considerably larger and was now present over the distal half of the surgical scar. It was 1½ inches (3.7 cm.) in diameter, not adherent, not moving with finger motions, not pulsating or fluctuating and not extremely tender except on extremely deep pressure. Roentgenograms revealed a large soft tissue mass with a trace of calcification.

On December 28 exploration revealed a moderately firm, brownish-red mass about 3 cm. in diameter, deep to the palmar fascia overlying the adductor of the thumb and the first lumbrical, and apparently incompletely encapsulated. A portion was subcutaneous, distal to the palmar fascia, volar to the first lumbrical tendon and the second metacarpal head. Pathologic examination revealed fibrosarcoma arising in the soft tissues of the hand and revealing many mitoses, anosocytosis, with variations in staining properties, and many areas showing abnormal, rounded nuclei.

On December 30 amputation was performed through the midpart of the left arm. Dissection of the specimen revealed that the neoplasm had not extended to within 1.5 cm. of the transverse carpal ligament and that the epitrochlear nodes were not involved. Up to the time of writing no metastasis has occurred.

Clinical Evidence.—About 5,000 years ago a mammary tumor was reported[1] as possibly due to trauma. Controversy has been voluminous since on the possible relation of trauma to new growth. Maude Slye[2] reported on the frequent occurrence of sarcomas at the sites of wounds in mice (later denied by Curtis[3]). The increased incidence of sarcoma occurring in "war injuries," in which considerable mechanical damage, infection, suppuration and splinters had exerted an effect over a long period, was conceded by Hellner,[4] who denied that single trauma could cause osteogenic sarcoma. Gillis and Lee[5] had described 24 cases of carcinoma arising in sinuses and scars in World War II wounds, whereas Melzner[6] reported on infrequent sarcoma following World War I wounds, and Hamant[7] reported likewise. Von Hansemann,[8] Gruber,[9] and Pick[10] noted no increase in tumor formation following these wounds. Stout[11] reported that in 36 of 66 cases of fibrosarcoma of the extremities the tumor developed in a scar.

Whereas Hellner[4] denied the possibility that a single trauma could cause giant bone cell tumor or osteogenic sarcoma, Inclan[12] reported in detail 3 cases of giant cell tumors of the knee following falls and knee injuries after several months, and Pack and Braund[13] described 3 cases of osteogenic sarcoma developing in traumatic hemothorax and hematoma of the thoracic wall.

Earlier reports (e.g., Lowenstein[14]) indicated that from 5 to 16 per cent of patients with sarcoma had a history of single trauma, but the evaluation of the history was usually inadequate. To add to the difficulties in evaluating this problem, after Meyerding[15] noted a relation between trauma and the development of fibrosar-

coma in 11.2 per cent of 152 patients, Ivins[16] later reviewed the Mayo Clinic series and added 39 patients of his own, stating that in no instance could trauma be considered the sole etiologic agent, although "a number of patients did complain of injury preceding discovery of the tumor mass."

Knox[3] in 1929 denied that a single trauma had ever caused a tumor, although aggravation was possible, and would not admit that such causation was possible until experimental methods could demonstrate a single trauma that regularly produced a tumor.

Equally adamant against the possible causation of new growth by trauma are the opinions of Hueper[17] ("There is not only a complete lack of supporting experimental evidence, but consistent failure to produce cancers in animals by acute nonspecific physical or chemical injury"); Ewing[18] ("It is generally assumed that trauma may activate a latent cancer and increase the growth energy of the cells, but the grounds for this view are unsatisfactory"); Stewart[19] ("I have never seen a cancer .... [due] to single trauma and I do not know anyone who has .... The absurd efforts made in our courts to emphasize the severity of the trauma rests on the nonsensical view that the metabolic changes which made a cell a cancer require a few additional dynes .... "), Perry,[20] Linell[21] and Warren and Sommer,[22] to name only a few. Mock and Ellis[23] also expressed the opinion that traumatic malignant change did not occur clinically. Ewing, who had written strongly against "traumatic cancer," is quoted by Davis[24] as follows in reviewing a case[25] of mammary carcinoma which developed in a boy following a severe contusion; "There is no escaping from the conclusion that in all probability, if not a certainty, the boy presented a genuine case of traumatic mammary cancer."

To cite briefly a few of the more recent cases reported, fibrosarcoma developed two months after a bruise of the sole on a stone; a fibrosarcoma developed three years later at the site where the femur had suffered a severe blow against a hydrant, with several weeks of severe pain in the knee[26]; a sarcoma of the sternum developed a couple of months after a severe contusion to this region[27]; fibrosarcoma appeared four months later at the site of a severe leg bruise[28]; fibrosarcoma appeared at the site of a bruise of the forearm[28]; a leg contusion was followed by fibrosarcoma in several months[29]; fibrosarcoma of the foot developed nineteen months after a contusion[30]; contusion and hematoma of the leg were followed in several months by fibrosarcoma[31]; severe contusion and hematoma of the axilla was followed by fibrosarcoma in nine months[32]; and a severe leg contusion with hematoma was followed in eighteen months by periosteal sarcoma at that site.[32]

Experimental Evidence. — Aside from the controversy over the role of trauma in clinical cases, the argument has been raised that experimental single trauma has never been able to cause neoplasm. Mackenzie and Rons,[33] however, observed that in rabbits whose skins had been tarred, though not sufficiently to form tumors, tumors subsequently developed at the site of superimposed trauma (namely, holes punched into the rabbits' ears). These observers stated, "So many are the human histories in which a blow or other injury has been followed by cancer, and so striking is the relationship between the two, that the term 'traumatic cancer' is sometimes used .... The present paper may shed light since cells may become neoplastic in considerable numbers yet never manifest themselves unless aided by extraneous influences. Trauma .... may act merely by stimulating neoplastic elements already long present." Shubik[34] in 1950 repeated and furthered this experimental

work. A clinical case strongly bearing on this was reported by Kotin and Kahler[35] in 1953, that of a worker whose hand was contaminated by oil and suffered trauma as a cocarcinogen. To quote: "Even when the trauma acts on already present, latent cancer cells and stimulates them to growth with the formation of a manifest tumor, it must be considered 'causal.' One knows today with great certainty that a single cancer cell or several cancer cells do not always lead to a . . . . manifest tumor. If the 'latent period' lasts throughout the individual's lifetime, no clinically recognizable tumor develops."

COMMENT

The relation of trauma to malignant disease may be causative, precipitating, aggravating or merely coincidental.[36] It seems highly improbable that so considerable a number of cases should be reported in which the occurrence of trauma and neoplasm at the same site was merely coincidental. A certain rough pattern can be discerned in these cases, the sarcomas following a single injury with temporary discomfort and frequently hematoma, and after subsiding, discomfort and swelling reappear in three months to three years.

Postulates that must be satisfied have been formulated by many observers.[37] Briefly, they require that trauma be authentic and significant, that tumor be absent prior to injury, that the site of injury and that of the tumor be identical, that the date of appearance of the tumor be not too remote and that the diagnosis of tumor must be definite.

As one observer has said,[32] "A manifest error of logic is involved in reasoning that because an occurrence is rare, it follows that it cannot and does not happen. A considerable number of proved cases indicate that trauma may occasionally cause cancer."

In the case here reported, further evidence was supplied by pathologic study, the result of which, because of their particular relevance to the controversial aspect of the matter, are presented here rather than in the case report itself.

Pathologic Picture. — Biopsy specimens taken on December 28 were described by the pathologist, Dr. Gerd T. Schloss, as follows: "The specimens have a similar appearance and consist partly of highly cellular areas with a moderate amount of collagen and a rather small amount of collagen, partly of areas with a large amount of cells. The cellular areas are composed of oval-shaped and even round cells with more or less oval-shaped vesicular nuclei. These nuclei show marked variation in size, shape and staining quality. There are numerous mitoses, typical and atypical. Some of these nuclei are surrounded by a clear halo, which might be due to shrinkage of the cytoplasm. The cells in these areas are separated by rather delicate collagen fibers. Other areas show more elongated and spindle-shaped cells that form interlacing bundles and are surrounded by thick collagen fibers. In these areas, there are numerous hemosiderin-laden phagocytes. Large areas of the material are necrotic. Other areas show hemorrhage.

"*Diagnosis:* Fibrosarcoma, arising in the soft tissues of the left hand."

After amputation, Dr. Schloss reported on the specimen as follows: "Gross: Left arm, amputated above the elbow joint. The region of the previously removed neoplastic tissue is dissected. The space formed by the lumbrical muscles of the index finger medially, the adductor pollicis posteriorly, the flexor pollicis longus laterally and the median nerve and palmar fascia anteriorly shows clotted blood and what seems to be remnants of neoplastic tissue. These remnants are selected for microscopic examination. The carpal tunnel is clear. The epitrochlear lymph nodes are

dissected out and do not look remarkable on gross examination.

"*Microscopic:* Some of these specimens consist of skeletal muscle and fibrous tissue with hemorrhage. Other specimens, however, are composed of the same closely packed spindle-shaped neoplastic cells as described in the previous specimen. The epitrochlear lymph nodes are partially replaced by fat tissue and do not show infiltration by neoplastic cells.

"*Diagnosis:* Amputated left arm with fibrosarcoma arising in the soft tissues of the hand."

Dr. Schloss sent the slides and a brief abstract of the case to Dr. Arthur Purdy Stout, and I quote from his reply: "The tumor of the hand of this patient is certainly remarkable, and I am far from sure I understand it. It seems to be a diffuse fibrous growth associated with a great deal of inflammatory cell infiltration and some necrosis. I might suppose that the interlaced bands of fibroblasts and collagen fibers were only foci of hyperplastic scar tissue if it was not for the presence of a fair number of mitoses. Such mitotic activity is not found in simple hyperplasia of scar tissue and in my opinion is evidence of malignancy. As far as I can see, this proliferation is not Schwannian, so I do not believe the nerve involvement is primary. I do not understand the inflammation; as you say, it is not like fasciitis, because of the fibrosarcomatous foci, but perhaps the fibrosarcoma developed in a case of fasciitis.

"In answer to your questions: Yes, I believe it is a malignant fibrosarcoma capable of metastasis. I believe it would have metastasized either without any surgical intervention or with incomplete removal. I believe amputation was the proper treatment, because it was essential to get rid of all of the tumor tissue as a possible life saving procedure. Simple fibromatoses sometimes stop growing for as long as twenty years before resuming growth. It must be a rare event for simple fibromatosis to change biologically into a metastasizing fibrosarcoma, but it can happen."

SUMMARY

A case is reported in which fibrosarcoma developed after eighteen months at the site of an injury to the palm.

A review of the literature reveals that a great number of similar cases has been reported. Some typical cases are briefly mentioned. Many observers, on the other hand, are implacable on their opposition to the concept of "traumatic cancer."

Experiments on animals have never succeeded in causing neoplasm. Other experiments, however, have shown trauma to be a cocarcinogen, and the clinical implication is briefly mentioned.

Clinical lesions, to be considered possible "traumatic cancers," must conform to certain postulates.

It is probable that trauma can rarely cause neoplasm, although evidence at present is not entirely conclusive.

ZUSAMMENFASSUNG

Es wird über den Fall eines Fibrosarkoms berichtet, das sich an der Stelle eines Traumas an der Handfläche 18 Monate nach der Verletzung entwickelte.

Eine Durchsicht der Literatur ergibt, dass eine grosse Anzahl ähnlicher Fälle veröffentlicht worden ist. Einige typische Beispiele davon werden kurz erwähnt. Andererseits gibt es viele Autoren, die an ihrem Widerstand gegen den Begriff eines "traumatischen Krebses" unerbittlich festhalten.

In Tierversuchen ist es niemals gelungen, durch Trauma einen Krebs hervorzurufen. Andere Versuche haben jedoch gezeigt, dass Trauma zur Entstehung

eines Krebses beitragen kann, und die klinische Bedeutung dieser Beobachtungen wird kurz erwähnt.

Natürlich müssen in klinischen Fällen, bei denen eine Erkrankung als möglicherweise "traumatischer Krebs" angesehen wird, gewisse Grundvoraussetzungen erfüllt sein.

Wahrscheinlich führt eine Verletzung nur selten zur Entstehung eines Krebses, aber auch diese Behauptung ist nicht völlig bewiesen.

RIASSUNTO

Viene riferito un caso in cui si sviluppò un fibrosarcoma nella sede di un trauma al palmo della mano, sofferto 18 mesi prima.

Una rassegna della letteratura mise in evidenza che molti casi simili sono stati riferiti e ne vengono brevemente menzionati alcuni. Molti osservatori, d'altra parte, sono decisi ad opporsi al concetto di "cancro traumatico."

Gli esperimenti sugli animali hanno sempre dato esito negativo, ma aotri esperimenti hanno dimostrato che i traumi sono dei fattori cancerogeni e ne viene brevemente menzionato il coefficiente clinico.

Naturalmente i casi clinici in cui la lesione si possa considerare "cancro traumatico" deve conformarsi a determinati postulati.

E' probabile che i traumi causino lo sviluppo di neoplasmi solo raramente, ma questo non è interamente conclusivo.

RÉSUMÉ

L'auteur rapporte un cas de fibrosarcome apparu dix-huit mois plus tard au lieu d'un traumatisme de la région palmaire.

Une revue de la littérature révèle qu'un grand nombre de cas similaires ont été rapportés, et quelques exemples typiques sont brièvement mentionnés. D'autre part, nombreux sont les négateurs convaincus du "cancer traumatique."

Les expériences sur l'animal n'ont jamais permis de produire un néoplasme. D'autres expériences ont cependant démontré que le traumatisme était un factuer co-carcinogène, et l'auteur cite les implications cliniques.

Bieu entendu, les cas cliniques dans lesquels la lésions et considérée comme un "cancer traumatique" possible doivent répondre à certaines conditions.

Il est probable que le traumatisme ne provoque que rarement le développement d'un néoplasme, mais cette supposition n'est pas entièrement concluante.

RESUMEN

Se reporta un caso de fibrosarcoma que se desarrolló diez y ocho meses después de un traumatismo en la palma de la mano.

La literatura revisada reveló que un gran número de casos similares han sido reportados y algunos casos típicos se mencionan brevemente. Por otro lado, hay muchos observadores que son implacables en su oposición al concepto de "cáncer traumático."

Experimentos en animales nunca han causado neoplasma. Otros experimentos sin embargo, han demostrado que el trauma es co-carcinógeno y su implicación clínica se menciona brevemente.

Por supuesto, casos clínicos en los cuales la lesión se considera como posible "cáncer traumático" deben adaptarse a ciertos postulados.

Es probable que el trauma cause el desarrollo de neoplasma solo raras veces, pero este postulado no es completamente concluyente.

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Otorhinolaryngologic Surgery

Mobilization of the Stapes for Improvement of Defects in Hearing Due to Clinical Otosclerosis

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IOWA CITY, IOWA

MOBILIZATION of the stapes practiced during the late nineteenth century,[1] discarded and recently revived,[2] is a subject of considerable interest to the medical profession as well as to some millions of those whose hearing loss is potentially reversible. It is, in addition to the fenestration operation, a possible therapeutic tool for the improvement of hearing in those whose loss is consistent with the diagnosis of clinical otosclerosis.[3]

Otosclerosis commonly causes varying degrees of stapedial ankylosis. Impairment in the mobility of this essential link in the ossicular chain results in a mechanical defect of the hearing system, which may be recognized audiometrically as tympanic deafness, or deafness of the middle ear (Fig. 1).

In tympanic impairment of hearing the bone conduction (BC) thresholds according to pure tone audiometric tests are normal or variably increased, depending upon the degree of neural degeneration. The air conduction (AC) thresholds are elevated to a level proportional to the degree of stapedial fixation, but not exceeding 50 to 60 decibels without some loss of bone conduction acuity. When the maximum loss in air conduction acuity is reached the stapes is generally considered to be firmly fixed, at least so far as sound pressure excitation is concerned. However, when the air-borne conduction thresholds do not differ by more than 30 decibels, the stapes may be only partially fixed (Fig. 2). The difference between the air conduction and the bone conduction thresholds is referred to as the cochlear reserve (CR) and indicates the potential of improvement in hearing, were the mechanical defect of stapes fixation to be corrected. In addition, the bone conduction threshold indicates the degree of normal hearing to be restored if the stapes can be completely mobilized. Thus, by mobilization of the stapes, it is possible to improve hearing to levels equal to the neural function or the bone-conduction thresholds (Fig. 3, *A* and *B*). In some instances this represents nearly normal hearing (Fig. 4, *A* and *B*).

Selection.—It is apparent that at least three categories of clinical otosclerosis are suitable for treatment by mobilization of the stapes. The first is classified on the basis of normal bone conduction thresholds for pure tone audiometry (bone conduction at 2,000 cycles not lower than 20 db.).

1. Normal bone conduction; cochlear reserve 25 db. or more (Fig. 5, *A* and *B*)
2. Bone conduction loss less than 30 db.; cochlear reserve 25 db. or more (Fig. 6, *A* and *B*)
3. Bone conduction loss greater than 30 db.; cochlear reserve 30 db. or more (Fig. 7, *A* and *B*)

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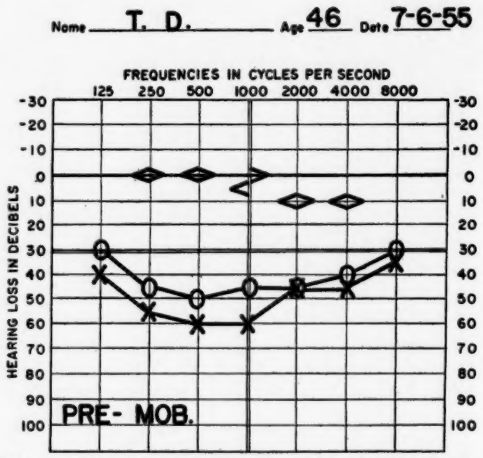
Criteria for selection are dependent upon the presence, in the results of hearing tests, of:

1. Ample air-bone conduction gap or cochlear reserve at frequencies 500, 1,000 and 2,000 cycles per second to permit an appreciable improvement. The magnitude of this gap should be at least 20 to 25 decibels.
2. Elevation of the bone conduction threshold at 500, 1,000, 2,000 cycles per second not greater than 30 db. Otherwise serviceable hearing for conversation would not be possible without a hearing aid.
3. Average elevation of the bone conduction threshold at 500, 1,000 and 2,000 cycles per second greater than 30 db., with a cochlear reserve of at least 30 db. Although serviceable hearing is not possible without a hearing aid, elimination of the mechanical defect (stapes fixation) may permit an improvement of hearing with a hearing aid.

The history of efforts to mobilize the stapes reveals failure in most instances to improve hearing or to maintain it once improvement had been achieved. In 1900, after a considerable number of such operations, Siebenmann declared that mobilization of the stapes was a useless procedure in the treatment of impaired hearing.[4] Fifty-two years later Rosen,[5] using the peritympanic approach of Lempert[6] to the middle ear, reported that, while testing for stapes fixation to determine a patient's suitability for fenestration, he had inadvertently brought about hearing improvement. This experience was followed by further reports declaring the success of the mobilization operation for treating impaired hearing due to clinical otosclerosis.[7] Since then a number of otologists throughout the world have taken up the search for data in order to reevaluate the operation's appropriate application.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HEARING LOSS IN DECIBELS
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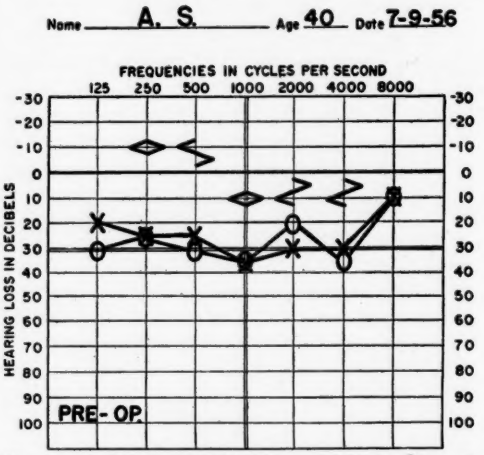
PRE- MOB.

Fig. 1.—Audiogram indicative of tympanic deafness (see text).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FREQUENCIES IN CYCLES PER SECOND
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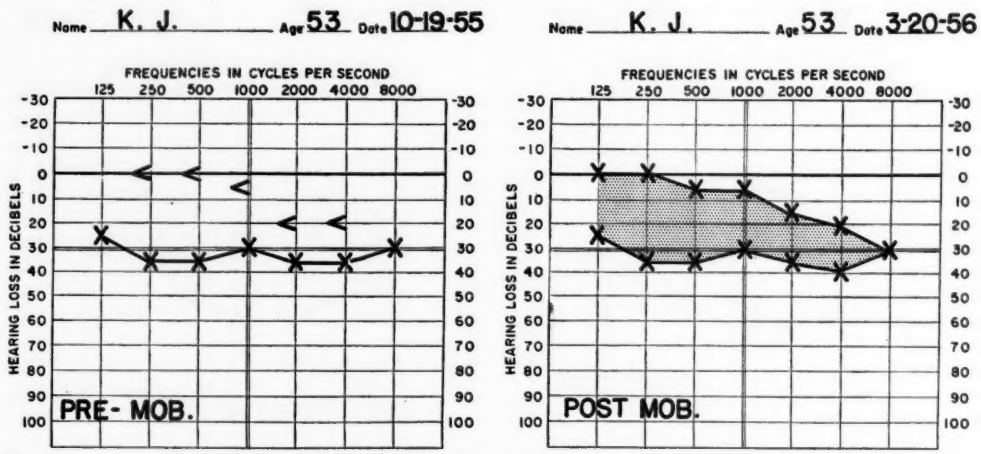
HEARING LOSS IN DECIBELS
-30 -20 -10 0 10 20 30 40 50 60 70 80 90 100
PRE- OP.

Fig. 2.—Audiogram indicating partial fixation of stapes (see text).

Surgical Technic and Management.—Technics may vary according to individual temperaments and personal preferences, but in principle they are much the same.

Patients accepted for surgical treatment are hospitalized for a total period of six to eight hours. Diet preferences are not interrupted, and no preoperative medication,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PRE- MOB.
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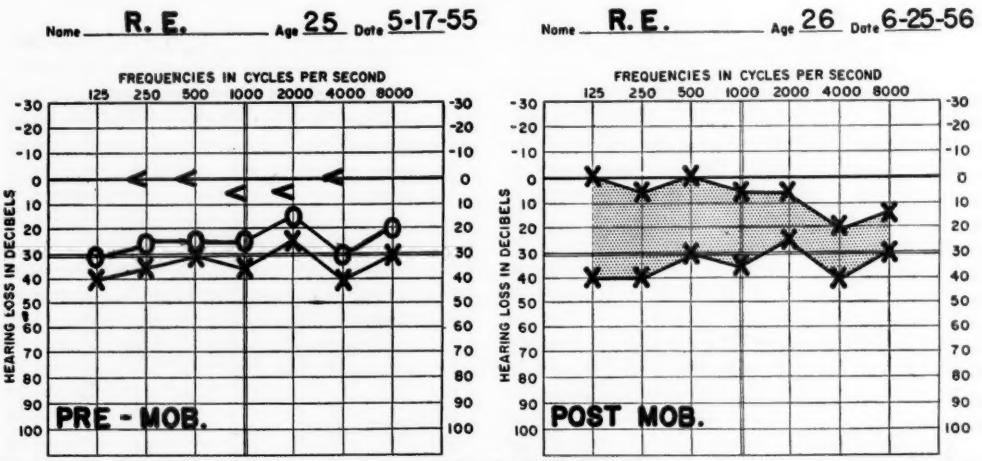
FREQUENCIES IN CYCLES PER SECOND
125 250 500 1000 2000 4000 8000
HEARING LOSS IN DECIBELS
POST MOB.

Fig. 3.—*A*, mobilization of stapes of left ear, Oct. 20, 1955. *B*, most recent audiogram, showing magnitude of sustained improvement.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FREQUENCIES IN CYCLES PER SECOND
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HEARING LOSS IN DECIBELS
PRE - MOB.
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FREQUENCIES IN CYCLES PER SECOND
125 250 500 1000 2000 4000 8000
HEARING LOSS IN DECIBELS
POST MOB.

Fig. 4.—*A*, mobilization of stapes of left ear, April 18, 1955. *B*, most recent audiogram, showing magnitude of sustained improvement.

except a protective antibiotic, is prescribed.

Anesthesia is obtained by undermining the cutaneous external auditory canal with 0.2 to 0.4 cc. of 4:1 combination of 2 per cent zylocaine and 1:1,000 epinephrine introduced with a 0.5 cc. tuberculin syringe and a 26-gauge short beveled hypodermic needle. One injection is made at the posteroinferior junction of the cartilaginous and osseous portions of the external auditory canal, in the tympanomastoid suture. Thus the entire posterior and inferoanterior canal wall and the adjacent portions of the tympanic membrane are completely anesthetized.

A peritympanic incision is made in the posterosuperior canal wall, extending from the 11 o'clock position to the 8 o'clock position in the right ear and from the 1

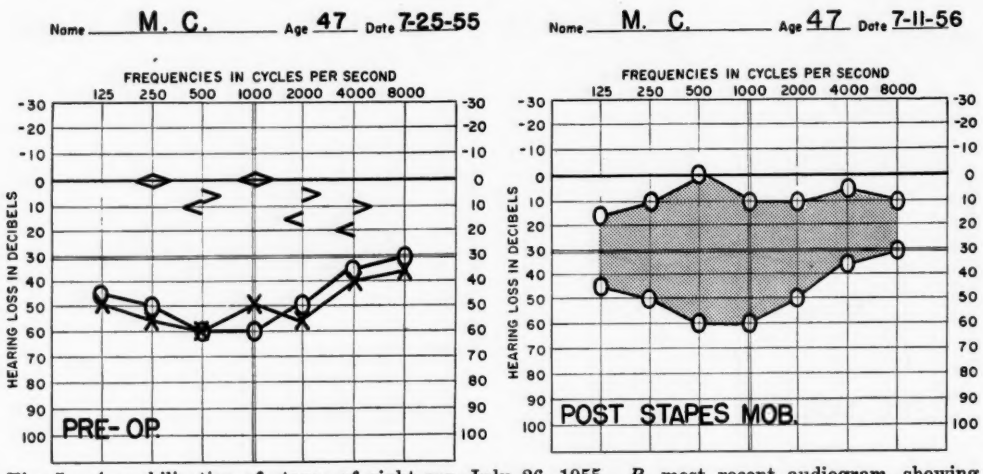
Name M. C. Age 47 Date 7-25-55
Name M. C. Age 47 Date 7-11-56
FREQUENCIES IN CYCLES PER SECOND
125 250 500 1000 2000 4000 8000
HEARING LOSS IN DECIBELS
PRE-OP.
POST STAPES MOB.

Fig. 5.—*A*, mobilization of stapes of right ear, July 26, 1955. *B*, most recent audiogram, showing magnitude of sustained improvement.

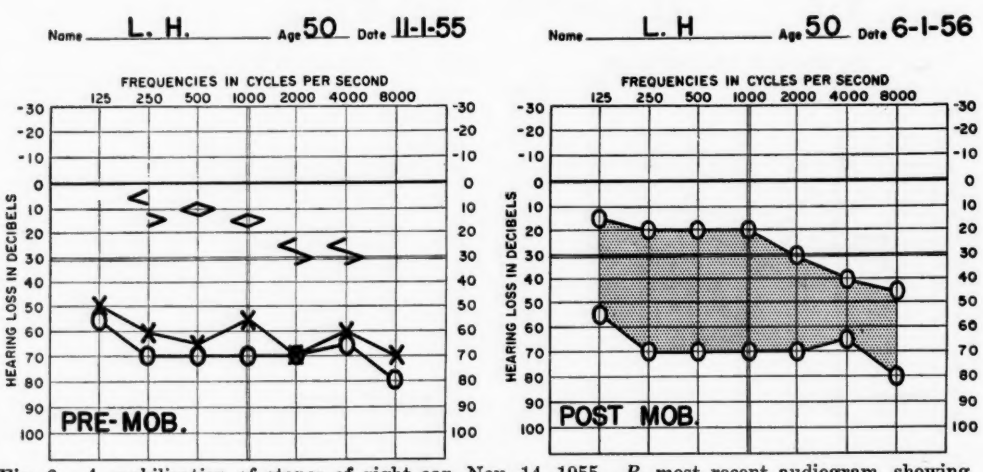
Name L. H. Age 50 Date 11-1-55
Name L. H Age 50 Date 6-1-56
FREQUENCIES IN CYCLES PER SECOND
125 250 500 1000 2000 4000 8000
HEARING LOSS IN DECIBELS
PRE-MOB.
POST MOB.

Fig. 6.—*A*, mobilization of stapes of right ear, Nov. 14, 1955. *B*, most recent audiogram, showing magnitude of sustained improvement.

o'clock position to the 4 o'clock position in the left ear and placed approximately 4 to 5 mm. external to the periphery of the tympanic annulus (Fig. 8*A*). The epithelial cuff is elevated toward the tympanic membrane until the annual ligament is encountered. At this point the operation is interrupted until complete hemostasis has been obtained. This is accomplished by placing, into the pocket formed by the incision, gelatin sponge mush comprised of shredded gelatin sponge mixed with topical thrombin.[7d] Immediately above the point of emergence of the chorda tympani nerve, the annular ligament is engaged and elevated from its annual groove (Fig. 8*B*). This permits detachment of the posterosuperior quadrant of the tympanic mem-

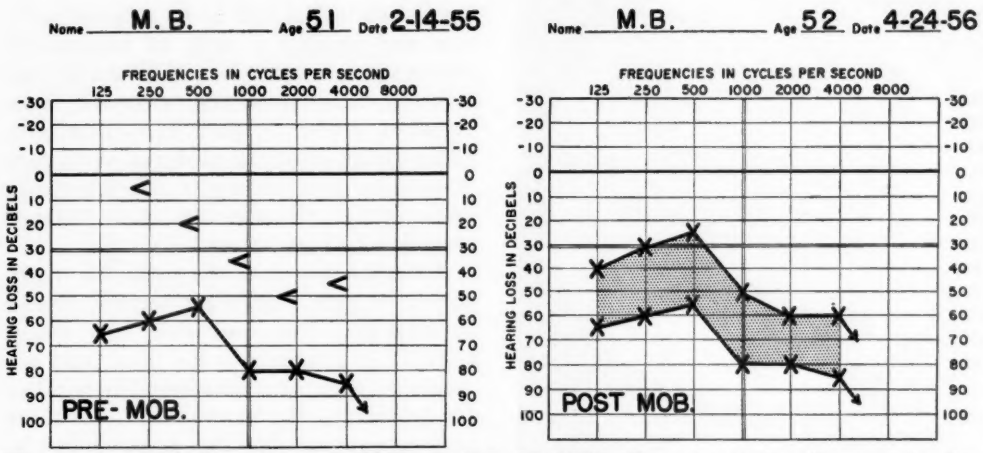
Name M. B. Age 51 Date 2-14-55
FREQUENCIES IN CYCLES PER SECOND
125 250 500 1000 2000 4000 8000
HEARING LOSS IN DECIBELS
PRE- MOB.
Name M. B. Age 52 Date 4-24-56
FREQUENCIES IN CYCLES PER SECOND
125 250 500 1000 2000 4000 8000
HEARING LOSS IN DECIBELS
POST MOB.

Fig. 7.—*A*, mobilization of stapes of left ear, Feb. 15, 1955. *B*, most recent audiogram, showing magnitude of sustained improvement.

brane, which is reflected anteriorly and inferiorly enough to expose the lenticular process of the incus, the lenticulocapitular joint, and the stapedial muscle tendon (Fig. 8*C*). Additional exposure may be obtained by lifting the chorda tympani from its annular bed and reflecting it anteroinferiorly. Occasionally it is necessary to remove about 1 mm. of osseous annulus to obtain adequate exposure. Thus the lenticulocapitular capsule is presented, through which a sharp-pointed shaft may be inserted to engage the head of the stapes. A to-and-fro force is then applied, first in a direction that crosses the long axis of the foot plate, then obliquely toward the long axis of the foot plate, until full freedom of motion can be exerted in the long axis of the foot plate and in all directions of stapedial mobility

Pure tone audiometric testing is employed in the operating room as a monitor of the successive degrees of improvement in hearing until maximum mobility of the stapes has been obtained. The circumstances that determine the degree of improvement are dependent on the firmness and extent of the otosclerotic process binding the stapes in the oval window. Should the entire foot plate be released from the otosclerotic process, excellent hearing improvement may result (Fig. 9, *A* and *B*). If only a segment of the foot plate is released, varying degrees of improvement may occur, depending upon the surface area disengaged.

Occasionally the crura are fractured, in which case leverage for continued efforts at mobilization by this technic is lost. There is great variation in the structure of the stapes among individual patients. In some the crura are exceedingly tenuous and the slightest pressure will cause a fracture. It has been shown that the most frequent site of fracture is at the juncture of the crura with the foot plate, where developmental osseous resorption is apt to be rather extensive. In the event of crural fracture, the foot plate still may be mobilized by the prying action of sharp picks[7c] or be fractured or pulverized with a miniature hammering device or a vibrator type of pulverizer. The latter procedures have not been encouragingly successful.

The operation is terminated by replac-

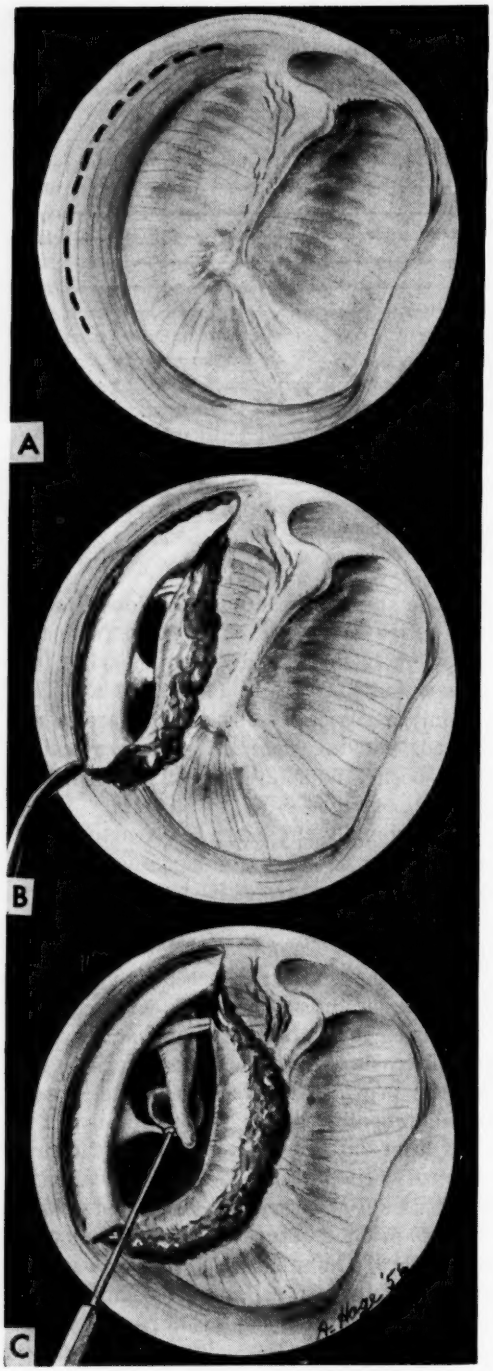

Fig. 8.—Operative technic.

ing the epithelial cuff in its original position and placing a strip of compressed gelatin sponge over the incision. Additional dressing is unnecessary, although some surgeons prefer to pack the canal with gauze strips or cotton pledgets. With rare exceptions, improvement in hearing occurs immediately. Occasionally it is delayed for three to four weeks.

After the operation the patient is transported to the audiology section, where postoperative hearing tests are made; then he is returned to his room and admonished to remain quiet until he is called for discharge. For two to four hours there may be earache, but this is controlled by analgesic agents administered before the patient becomes aware of pain, so that its anticipated intensity may be appreciably reduced.

Patients are discharged at about 4 o'clock of the same afternoon and instructed to return in four weeks. A prescription for an antibiotic is given to protect the site of incision for one week, and instructions are given to begin manual pneumomassage ten days after the operation. Upon the patient's return four weeks after the operation a small crust that will have formed over the incision has contracted and may be removed. The operative site is completely healed, and there is little evidence of surgical intervention.

Complications. — Complications rarely follow mobilization of the stapes. Hearing may become worse as a result of crural fracture, but the loss seldom exceeds 10 db. Damage to the inner ear is a possibility, but it has not occurred in the course of this study. Persistent vertigo does not occur. Injury to the facial nerve has been reported, but this is extremely rare. If the chorda tympani nerve is injured, complaint of perverted taste and dryness of the tongue may result. Temporary perforations of the tympanic membrane may occur but should not be of serious conse-

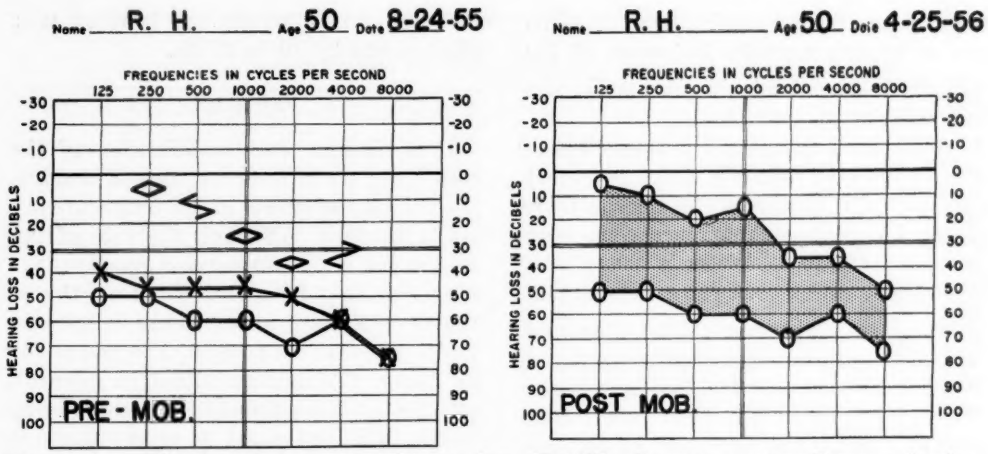
Name R. H. Age 50 Date 8-24-55
FREQUENCIES IN CYCLES PER SECOND
125 250 500 1000 2000 4000 8000
HEARING LOSS IN DECIBELS
PRE-MOB.
Name R. H. Age 50 Date 4-25-56
FREQUENCIES IN CYCLES PER SECOND
125 250 500 1000 2000 4000 8000
HEARING LOSS IN DECIBELS
POST MOB.

Fig. 9—*A*, mobilization of stapes of right ear, Aug. 25, 1955. *B*, most recent audiogram, showing magnitude of sustained improvement.

quence if ordinary technical caution is exercised. In the event of a perforation, a tissue paper diaphragm or a compressed gelatin pledget may be placed over the defect to seal the middle ear during the healing process.

It is possible that otitis media, with its varied complications, may result from mobilization of the stapes unless adequate antibiotic prophylaxis is prescribed. Despite this protective consideration, excessive surgical trauma may invite resistant infection, as it may after any surgical procedure.

On rare occasions the peritympanic incision may be the source of postoperative bleeding, but this is effectively controlled by firmly inserting a cotton pledget in the external auditory meatus to seal off the canal. Meddling with this annoyance is likely to result in contamination and an active infection.[8]

Results.—Four hundred stapes mobilizations were done in the eighteen months between October 1954 and April 1956. The results for the preoperative category one are shown in Table 1. The total number of ears treated in this group was 210. Hearing improved to the level of 30 db. or more in 94 ears (44.7 per cent). Subsequent regressions, most of them occurring within four weeks after the operation, were noted in 14 ears, leaving a net successful result for 80 ears or 38.1 per cent. Hearing in 63 instances (30 per cent) improved 15 db. or more but did not reach the 30 db. level. Eventual regressions withdrew 16 initial improvements; thus, 47 (22.4 per cent) sustained an improvement of 15 db. or more for six to eighteen months. Hence, total improvement was obtained in 127 (60.5 per cent); total regression in 30 (14.3 per cent), and no improvement in 53 (25.2 per cent).

In preoperative category 2 there were 171 operations (Table 2). Sixty of these, or 35.1 per cent, improved hearing to the 30 db. thresholds or better, but subsequent regressions subtracted 11 within four months after the operation, so that at the time of writing there are 49, or 28.7 per cent, with hearing improvement sustained for six to eighteen months. In 53 (31.0 per cent) appreciable improvement was achieved but did not reach the 30 db. level

of practical and serviceable hearing. Fifteen of these eventually lost some of the improvement, but 38, or 22.2 per cent, have retained it.

Preoperative category 3 is comprised of only 19 ears, of which 8 (42.1 per cent) were initially improved 15 db. or more (Table 3). Subsequent regression, however, occurred in 6, leaving a net total of 2 (10.6 per cent) with some satisfaction.

Considering all preoperative categories, Table 4 shows an initial improvement sufficient to restore practical and serviceable hearing to 154 ears (38.5 per cent). Subsequent regressions occurred in 25 ears. Improvement has been sustained in 129 (32.3 per cent). Among the 124 ears (31 per cent) that regained hearing of 15 db. or more, there were 37 that relapsed: hence 87 (21.7 per cent) have retained their improvement.

In 216 (54 per cent) of the 400, sustained hearing improvements of appreciable magnitude have resulted from 400 mobilizations. There was a total of 62 (15.5 per cent) regressions; 122 (30.5 per cent) remained unchanged or unimproved, including 10 in which the hearing was made worse by 10 to 15 db.

COMMENT

It is obvious that mobilization of the stapes results in improvement of hearing, but the lasting effects of the procedure are still uncertain. Although the rate of improvement is satisfactory, regressions are discouragingly frequent. Even so, the 62 regressions noted in this study do not represent irreversible results. The stapes can be and has been remobilized at intervals of nine to twelve months, the results being increasingly sustained in some cases. In some instances this, coupled with self-applied manual pneumomassage, may delay the recurrence of stapedial ankylosis. The results of repeated operations have not been included in this report.

The question of why the operation was discarded many years ago remains puzzling, but the answer may well be related to the matter of sustained results. It is well known that otosclerosis develops and affects hearing, sometimes rapidly but more often so slowly that the patient becomes victimized without knowing pre-

TABLE 1.—*Normal Bone Conduction: Cochlear Reserve 25 Decibels or More (Two Hundred and Ten Cases)*

1.	Air conduction improved to 30 db. or more	N	94	44.7%		
	Subsequent regressions		14			
	Total				N 80	38.1%
2.	Air conduction improved 15 db. or more but not to 30 db. threshold	N	63	30.0%		
	Subsequent regressions		16			
	Total				N 47	22.4%
	Total improvements				N 127	60.5%
	Total regressions				N 30	14.3%
3.	No change				N 53	25.2%
	Total				N 210	100 %

TABLE 2.—*Bone Conduction Loss Less than 30 Decibels, Cochlear Reserve 25 Decibels or More (One Hundred and Seventy-One Cases)*

1.	Air conduction improved to 30 db. or more	N 60	35.1%		
	Subsequent regressions	11			
	Total			N 49	28.7%
2.	Air conduction improved 15 db. or more but not to 30 db. threshold	N 53	31.0%		
	Subsequent regressions	15			
	Total			N 38	22.2%
	Total improvements			N 87	50.9%
	Total regressions			N 26	15.2%
3.	No change			N 58	33.9%
	Total			N 171	100 %

TABLE 3.—*Bone Conduction Loss Above 30 Decibels, Cochlear Reserve 30 Decibels or More*

1.	Air conduction improved 15 db. or more	N 8	42.1%		
	Subsequent regressions	6			
	Total improvements			N 2	10.6%
	Total regressions			N 6	31.5%
2.	No change			N 11	57.9%
	Total			N 19	100 %

TABLE 4.—*All Preoperative Categories*

1.	Air conduction improved to 30 db. or more	N 154	38.5%		
	Subsequent regressions	25			
	Total			129	32.3%
2.	Air conduction improved 15 db. or more but not to 30 db. threshold	N 124	31.0%		
	Subsequent regressions	37			
	Total			87	21.7%
	Total improvements			216	54.0%
	Total regressions			62	15.5%
3.	No change			122	30.5%
	Total number of patients in study			400	100 %

cisely when. It is probable that what is considered sustained hearing improvement today will give evidence of insidious deterioration as the months or years go by, but if mobilization of the stapes continues to give good hearing for at least one year, it should be considered a useful and beneficial operation. It can be repeated indefinitely in the same ear, so far as is currently known, if the structures involved are not extensively or irreversibly damaged. Certainly improved surgical facilities and control of infection have played a significant role in the renewed application of this procedure.

When an attempt at mobilization of the stapes fails to improve hearing in one ear, it is possible that the procedure may be successful in the opposite ear. Apparently this is due to differences of structure and otosclerotic involvement in the two ears. At any rate, failure in one ear does not necessarily mark the opposite ear for failure also.

The greatest handicap under which a surgeon works is the unpredictability of results. Aside from the signs of clinical otosclerosis, nothing is revealed in the examination or the hearing tests that lends a clue as to the individual outcome of mobilization. To be sure, some audiograms appear to offer a more promising outlook than others, but singular predictability has been not only frustratingly inaccurate but impractical. Selection, then, is dependent on the nature of the hearing loss and the potential of improvement apparently available (according to the audiogram) if the stapes can be freely mobilized. Beyond recognition of clinical otosclerosis as the cause of the hearing loss, therefore, there are no reliable criteria on which a prediction of success can be based.

Complications are of negligible significance if ordinary surgical skill is employed in the execution of the operation. Should complications occur, the responsible surgeon has little difficulty in managing them effectively.

The patient finds this a relatively easy operation to endure, and when it is successful he is amazed at the ease with which hearing has been recovered. When it is a failure, at least his disappointment is not overburdened with the inconvenience and annoyance of extended postoperative care and discomfort.

SUMMARY AND CONCLUSION

The results of 400 stapes mobilization operations are analyzed according to the degree of hearing improvement obtained in three preoperative categories. It is evident that the extent of success is dependent on good neural function as indicated by the bone conduction thresholds for pure tone audiometry and a cochlear reserve represented by an air-bone conduction difference of at least 25 to 30 decibels.

Thirty-two per cent of the 400 patients operated on showed a remarkable hearing improvement, and 22 per cent achieved a hearing improvement that was helpful. In addition, there were 62 patients (15.5 per cent) whose hearing regressed after initial improvement. Many of these have been reoperated on, with increasingly sustained hearing satisfaction. Some have undergone fenestration, and others have elected to wear a hearing aid. The results have been excluded from this report and will be made the subject of another study.

In the group of 122 failures, 10 patients showed an additional loss of 10 to 15 decibels; otherwise there were no adverse effects to preclude any patient's ability to use a hearing aid at least as effectively as before the operation.

Mobilization of the stapes provides a relatively uncomplicated method of improving hearing in an appreciable number of patients whose impairment is consistent with the diagnosis of clinical otosclerosis.

It does not change the structure of the ear and involves a minimum of mental and physical inconvenience.

ZUSAMMENFASSUNG UND SCHLUSSFOLGERUNGEN

Die Ergebnisse von 400 Mobilisierungsoperationen des Steigbügels werden auf Grund der erzielten Verbesserung des Hörvermögens in drei postoperativen Kategorien nachgeprüft. Der Grad des Erfolges hängt offensichtlich vom Umfang der natürlichen Funktion ab, die durch die Schwellenwerte der Knochenleitung für die reine Tongehörmessung und durch eine kochleare Reserve, die einen Unterschied zwischen Luft-und Knochenleitung von mindestens 25 bis 30 Dezibels aufweist, ausgedrückt wird.

Bei 32 Prozent der 400 operierten Patienten war die Verbesserung des Hörvermögens bemerkenswert, bei 22 Prozent von gewissem Nutzen. In 62 Fällen (15,5 Prozent) liess die Hörkraft nach anfänglicher Besserung wieder nach. Viele von diesen wurden nachoperiert und konnten ihre Hörfähigkeit für wachsende Zeiträume erhalten. An einigen Kranken wurde eine Fensterungsoperation ausgeführt, andere zogen es vor, einen Hörapparat zu tragen. Die Erfolge in diesen Fällen bleiben in der vorliegenden Arbeit unberücksichtigt und werden in einer weiteren Untersuchung nachgeprüft werden.

In der Gruppe von 122 Versagern zeigten zehn Kranke einen weiteren Gehörverlust von 10 bis 15 Dezibels; sonst traten keine nachteiligen Erscheinungen auf, die die Fähigkeit des Kranken, den Hörapparat mit wenigstens der gleichen Wirksamkeit wie vor der Operation zu benützen, beeinträchtigt hätten.

Die Mobilisierung des Steigbügels stellt ein verhältnismässig unkompliziertes Verfahren zur Besserung des Hörvermögens bei einer bemerkenswerten Anzahl von Kranken dar, bei denen die Hörschädigung mit der klinischen Diagnose einer Otosklerose in Einklang steht.

Die Methode führt zu keiner Veränderung des Baues des Ohres und lässt sich mit einem Mindestmass von seelischer und körperlicher Beanspruchung des Kranken ausführen.

RESUMEN Y CONCLUSIONES

Se analizan los resultados de 400 operaciones de movilización del estribo de acuerdo con el grado de mejoramiento en la audición obtenido en tres categorías postoperatorias. Es evidente que el grado de éxito depende de una buena función natural como lo indican los umbrales de conducción ósea para la audiometría de tonos puros y la reserva coclear representada por una diferencia de conducción ósteo aérea por lo menos de 25 a 30 decibeles.

Treinta y dos por ciento de los 400 pacientes operados mostraron mejoría marcada y 22 por ciento lograron alguna mejoría en la audición. Además, hubo 62 pacientes (15.5 por ciento) cuyo poder auditivo dismimuyó después de una mejoría inicial. Muchos de esos casos han sido reoperados con mejoría satisfactoria y duradera en la audición. Algunos se han sometido a fenestración y otros han preferido usar aparato auditivo auxiliar. Los resultados se han omitido en este reporte y serán objeto de otro estudio.

En el grupo de 122 fracasos, 10 pacientes mostraron una disminución de 10 a 15 decibeles; por otra parte, no hubo efectos adversos que impidieran a los pacientes usar un aparato auditivo auxiliar por lo menos tan efectivamente como antes de lo operación.

La movilización del estribo proporciona un método relativamente sencillo de mejorar la audición en un número apreciable de pacientes cuyo defecto conducía al diagnóstico clínico de otosclerosis.

No cambia la estructura del oído y da un mínimo de inconvenientes mentales y físicos.

CONCLUSIONI RIASSUNTIVE

Vengono analizzati i risultati di 400 interventi di mobilizzazione della staffa, basandosi sul diverso grado di miglioramento delle facoltà uditive ottenuto. E' chiaro che la misura del successo è legata a una buona funzione naturale quale può essere indicata dai limiti della conduzione ossea per i toni puri e dalla riserva cocleare rappresentata da una differenza di almeno 25-30 decibels nella conduzione aerea-ossea.

Nel 32% dei malati si ottenne un forte miglioramento e nel 22% un miglioramento. Inoltre vi furono 62 casi (15,5%) in cui l'udito diminuì dopo un iniziale miglioramento. Molti di questi furono rioperati con successo. In alcuni era stata fatta la fenestrazione ed altri portavano apparecchi acustici. Nel gruppo dei 122 insuccessi, dieci malati ebbero una ulteriore perida di 10-15 decibels; d'altra parte non vi erano controindicazioni per l'uso dell'apparecchio per lo meno come prima dell'operazione.

La mobilizzazione della staffa è un metodo relativamente semplice per migliorare l'udito in un apprezzabile numero di casi di otosclerosi. Esso non modifica la struttura dell'orecchio e offre il minimo di inconvenienti.

RÉSUMÉ ET CONCLUSIONS

L'auteur analyse 400 cas dans lesquels il a procédé à la mobilisation des étriers. Il est évident que l'étendue du résultat obtenu dépend de la bonne fonction naturelle indiquée par les paliers de conduction osseuse pour l'audiométrie pure et une réserve cochléaire représentée par une différence de conductibilité aid-os d'au moins 25 à 30 décibels.

32% des 400 malades opérés ont montré une amélioration frappante; 22% ont récupéré une audition utile; 15,5% (62 malades) ont présenté une diminution de l'audition après une amélioration initiale. Plusieurs d'entre eux ont été ré-opérés avec des résultats satisfaisants. Quelques-uns ont subi la fénestration, d'autres ont choisi de porter un appareil auditif. Les résultats obtenus feront l'objet d'une étude ultérieure. Dans le groupe des échecs (122 cas) 10 malades ont montré une diminution auditive supplémentaire de 10 à 15 décibels.

La mobilisation des étriers constitue une méthode relativement simple et efficace dans un grand nombre de cas (otosclérose). Cette intervention ne modifie pas la structure de l'oreille; elle est suivie d'un minimum d'inconvénients physiques ou psychiques.

SUMARIO E CONCLUSOES

Os resultados de 400 mobilizações do estribo são analizados de acordo com o grau de audição obtido em três categorias pós-operatorias. É evidente que o sucesso depende de uma boa função indicada pela madida da condição óssea nos tons audiometricos puros e uma reserva coclear representada por uma diferença de condução aerea-óssea de pelo menos 25 a 30 dicibeis.

Trinta e dois por cento dos 400 pacientes operados mostraram uma notavel melhoria e 22% alcançaram um grau de audição util. Sessenta e dois pacientes (15.5%) tiveram nova perda de acuidade após haverem melhorado inicialmente. Muitos foram re-operados e ficaram satisfeitos. Outros foram submetidos a fenestração emquanto alguns preferiram usar aparelhos auxiliares da audição. Os resultados foram excluidos desta communicação e con-

stituirão assunto de novo trabalho.

No grupo de 122 insucessos, 10 tiveram uma perda adicional de 10 a 15 decibeis pelo que não houve inconveniente em que tornassem a usar aparelhos auxiliares da audição. A mobilização do estribo representa um método relativamente simples de melhorar a audição em apreciavel número de doentes cujo diagnóstico era, clinicamente, de otoesclerose.

Não há modificações estruturais da orelha e as repercussões físcias e mentais são insignificantes.

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Whenever a textbook is written of real educational worth, you may be quite certain that some reviewer will say that it will be difficult to teach from it. Of course it will be difficult to teach from it. If it were easy, the book ought to be burned; for it cannot be educational. In education as elsewhere, the broad primrose path leads to a nasty place. This evil path is represented by a book or a set of lectures which will practically enable the student to learn by heart all the questions likely to be asked at the next external examination.

—*Whitehead*

Plastic and Reconstructive Surgery

Treatment of Maxillofacial Injuries in Children

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A PAUCITY of information exists regarding the treatment of maxillofacial injuries in the younger age groups. This subject presents more problems than would occur in the adult group of patients with similar injuries.

An overall description and evaluation of the various procedures that have proved their value in the management of facial fractures in children appears to be needed. This applies particularly to young children in whom incomplete development of the dentition is present, associated with only partial development of the facial bones. Concomitant with this there is the patient's immaturity, which makes cooperation with the plastic surgeon difficult, particularly during the initial phase of treatment.

Definitive Treatment.—Whether definitive treatment can be instituted immediately depends on the exclusion of other associated injuries, such as: (1) fractures of the skull; (2) intracranial trauma; (3) thoracic and/or abdominal injuries, or (4) fractures of the extremities, etc.

Even when associated injuries are present, however, the advice and assistance of the plastic surgeon should be sought immediately:

1. To plan the future treatment of the patient as intelligently as possible.

2. To prevent any further damage or separation of the fragments, with increased adjacent injury.

3. To be assured of the maintenance of an adequate airway.

4. To control hemorrhage from the traumatized facial areas during the initial stages of the examination.

Healing of fracture sites is rapid in children, and delayed or improper reduction will cause permanent loss of function with possible disfigurement.

Dressings. — The application of bandages and dressings, except to cover lacerations, should be used with care, particularly the so-called four-tailed type of bandages used by some surgeons in immobilization of severe mandibular fractures. Upward traction with this type of bandage may elevate the mandibular fragments, causing further decrease in the free air space. This immediately becomes a dangerous problem in maintenance of the adequate airway.

Diagnosis of Fractures of the Jaw.—Children are usually apprehensive during the initial examination. Although their behavior varies, it is frequently altered adversely by the presence of the anxious parents, whose concern is quickly conveyed to the child. Examination can often be performed more efficiently without their presence. The following points should be considered:

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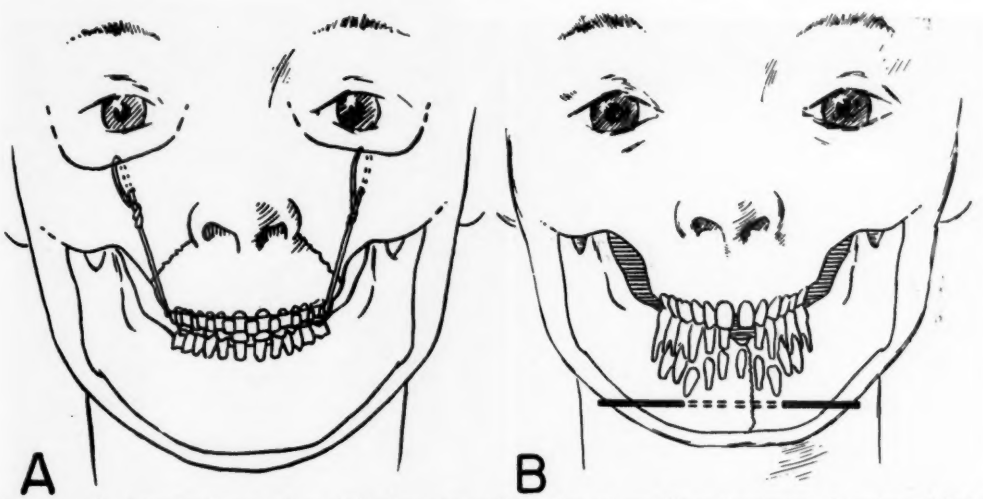

Fig. 1.—*A*, extra-oral use of orbital rims for stabilization of maxillary fractures. *B*, extra-orbital pin fixation (Kirschner wire technic). This also can be used, care being taken to avoid permanent tooth follicles.

1. Any gross abnormalities in the general contour of the face should be investigated, with a minimum of handling.

2. Light palpation will disclose any sensitive area and any irregularities of the mandible, maxillae, zygomatic arches or zygomas.

3. A careful evaluation should be made of the occlusal status and of any displacement or mobility of the jaws.

4. The presence of submucosal hemorrhagic areas should be kept in mind, since this is usually indicative of underlying damage to the bone, particularly on the lingual aspect.

Roentgenograms.—The taking of roentgenograms, accurately positioned and properly exposed, is the most important of the diagnostic procedures in the young patient.

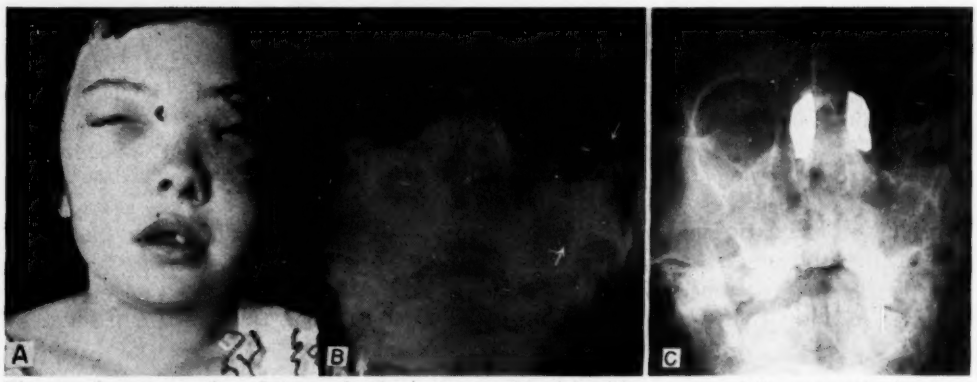

Fig. 2.—*A*, preoperative photograph of an 11-year-old girl with a severe left zygomatic fracture. *B*, preoperative Waters view of facial bones reveals posterior and lateral displacement of left zygoma. Also visualized are multiple fractures of nasal bones. *C*, postoperative Waters view revealing 32-gauge stainless steel wires immobilizing left zygoma in its normal anatomic relation. Wiring was also necessary for the nasal fractures.

Fig. 3.—*A*, use of a traction chin strap to a light head cast in conjunction with a circumferential nasal-mandibular wire for uncomplicated mandibular fractures. *B*, posteroanterior view of mandible with circumferential stainless steel wire in place.

The following positions have been found to be the most satisfactory:

Mandibular Fractures: 1. *Right and left lateral prosections* to show the vertical ramus, angle and body of the mandible.

2. *Posteroanterior* chin-nose position of the skull to show the complete mandible.

3. *Laminagraphs*, when available, to obtain accurate visualization of the temporomandibular joint areas, condyles and coronoid processes.

Maxillary and Zygomatic Fractures: The Stereo Water position usually results in excellent visualization of the maxillae, sinuses and zygomas. A mentovertex roentgenogram clearly outlines the zygomatic arches, and any deformity that may be present can usually be seen with this type of film.

General Treatment of Maxillary and Mandibular Fractures.—The usual wiring technics used for older patients are often not suitable when deciduous teeth must be wired, as these teeth have bullous crowns, without the helpful undercuts in the cervical portions of the teeth. The permanent teeth are in various stages of eruption; their root structure is inadequately developed and only partially calcified. Eyelet wiring is possible, with use of (a) deciduous teeth (only when there has not been resorption of the root structure) or (b) permanent teeth when the root structure is fully developed, with closure of the den-

Fig. 4.—*A* and *C*, preoperative photographs of 10-year-old girl who sustained a bullet wound to left mandible and adjacent soft tissues. Point of entry can be seen near lower left oral commissure; area of exit, in the left inferior auricular area. *B*, lateral roentgenogram showing destruction of body of mandible. Minimal débridement was carried out for maximal preservation of permanent tooth follicles and mandibular growth. *D*, postoperative photograph, taken six months after discharge.

A
B
C
D

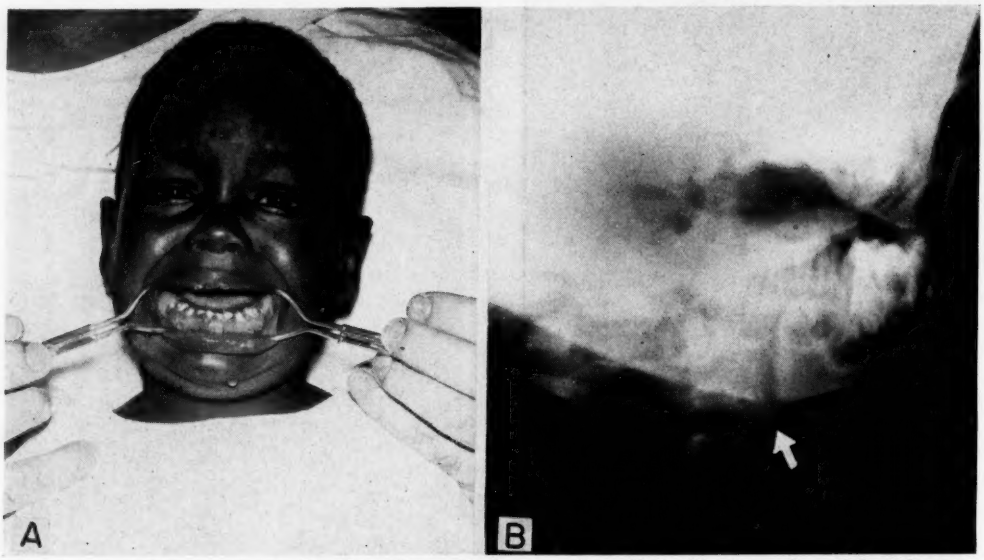

Fig. 5.—*A* and *B*, boy 8 months old with small clear acrylic splint with circumferential wiring stabilizing a mandibular fracture (*B*).

tal apices.[1]

Treatment of Maxillary Fractures.—Fractures of the maxillary area in children are most frequently due to a forward fall, incurred by tripping or falling against a protruding object or even as a result of a typical "dashboard injury" to a guest passenger in an automobile.[2]

An object thrown, such as a book, a stone, or a baseball bat, exerts a similar force. In such instances the head is turned instinctively to one side in an attempt to avoid being struck, and as a result the force is usually exerted in an oblique direction.

The high degree of elasticity of the maxillary bones in the child permits a considerable amount of distortion of the facial framework before any actual fractures occur.

1. The most common type of maxillary fracture observed in children involves separation, either partial or complete, and disruption of the labial or buccal plates of the alveolar bone around the teeth. As a result of this the teeth are loosened, because of the loss of bony structural support around them.

Treatment: Treatment of fractures of the alveolar plates consists of immobilization by supporting the loose teeth and alveolar plate on an arch bar which is stabilized on the sound, unaffected teeth. The shape of the crowns of the deciduous teeth and the lack of contact may cause some difficulty in proper immobilization. The use of orthodontic bands or caps may then become necessary.

2. Fortunately, fractures of the entire maxilla or maxillae are not frequent. When they do occur, however, and if a sufficient number of permanent teeth are present, an arch bar can be wired to the upper teeth, with use of orthodontic bands if necessary. Stabilization can be obtained for utilizing the lower teeth for the proper occlusal relation; also, if necessary, a head cast with wire traction attachments to the

maxilla can be further incorporated for immobilization of a complete fracture of the midportion of the face.

3. It may be difficult to secure anchorage for an arch bar or eyelet loop wiring in a child 7 years of age or younger, and an acrylic splint over the upper teeth may then be utilized to good advantage. The splints are made by taking colloid impressions of the upper and lower teeth and the associated related structures. This may necessitate anesthetizing the child for a short time. After this the acrylic splints can be made from the models poured from the original impressions. When the splint has been properly seated in the mouth, wires of stainless steel are inserted through the soft tissues overlying the maxillae, connecting the splint to a light plaster head cast.

4. Some inconvenience and difficulty may be encountered in maintaining a traction head cast on a child with maxillary fractures. A procedure that eliminates the use of a head cast has been described by Adams, who suggested the drilling of small holes in the infraorbital rims. Through these, stainless steel wires are threaded and looped around each of the rims, after which they are attached to the maxillae in order to maintain them in their normal anatomic position.[3] This works very satisfactorily when only the maxillae are fractured (Fig. 1 *A*).

Zygomatic Fractures: The majority of zygomatic and zygomatic arch fractures can be easily handled by either of two means. 1. The Gillies approach, utilizing a periosteal elevator which is inserted through an incision in the temporal area. The periosteal elevator follows the path of the temporal muscle under the zygomatic arch, and any malalignment or depressed fracture, if one exists in the zygomatic process of the temporal bone or the

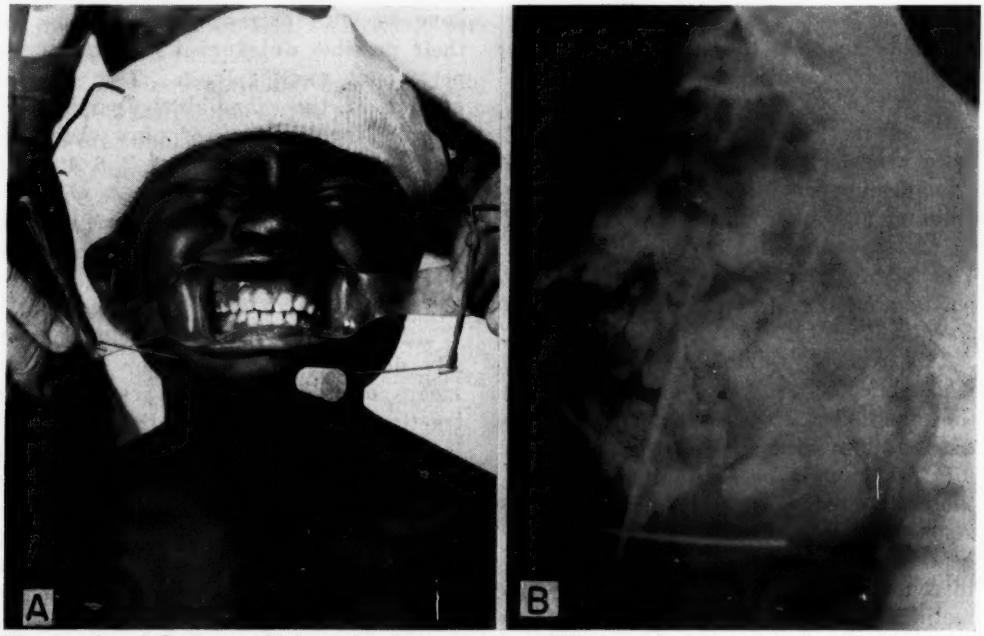

Fig. 6.—*A* and *B*, 5-year-old boy with fracture of mandible in region of symphysis and right body. Immobilization was obtained by careful insertion of Kirschner wires as shown in *B*.

zygomatic process of the zygoma, can be easily elevated.

The elevator can be inserted further inferiorly for fractures of the body of the zygoma, and in many cases elevation of the entire segment can be accomplished from this same approach.

2. *The antral approach.* A small oral incision can be made in the buccal mucosa and a maxillary sinus approach used for inferior elevation of the entire zygoma.

3. *Direct Wiring.*—Badly displaced zygomatic fractures should be reduced and maintained in position by utilizing an extraoral approach. A small 28-gauge stainless steel wire is threaded across the fracture lines of the zygoma. The fracture sites can then be maintained in their normal anatomic relation without any additional appliances (Fig. 2, *A*, *B* and *C*).

Mandibular Fractures: Fractures of the mandible considerably outnumber those of the maxilla. This is due to several factors: (1) the more vulnerable position of the lower jaw; (2) its mobility; (3) the horseshoe shape of the mandible, and (4) the lack of any shock-absorbing mechanism.

In contrast, the maxillae are formed of more cancellous bone, which is soft and spongy, supported and protected by the cranium above, by the zygomatic arches on the sides and by the mandible below. This middle area of the face is also proportionately smaller and in a less conspicuous location.

Treatment of Mandibular Fractures: 1. Uncomplicated fractures of the body of the mandible with little displacement are treated by manipulation of the fragments into proper position and alignment to establish occlusion, with the patient under general anesthesia. A supporting plaster head cast and chin strap are then utilized, in combination with eyelet wiring of the teeth if there are sufficient unresorbed deciduous teeth or erupted permanent teeth (Fig. 3, *A* and *B*, and Fig. 4, *A*, *B*, *C* and *D*).

2. Complicated fractures with marked displacement of the mandibular fragments will necessitate reduction with the patient under anesthesia and the use of an acrylic splint after impressions of the teeth have been taken and a splint formed to reestablish the occlusal relation. The prosthesis is then stabilized, preferably by circumferential wiring to stabilize the splint to the mandible (Fig. 5, *A* and *B*).

Feeding is simplified by utilizing the splint technic, as the normal movements of the mandible can be retained even though the mandibular fragments are immobilized. This is extremely important with small children and is the treatment of choice in this group.

3. The use of extraoral pin fixation (Kirschner wire) is necessary in isolated instances. The routine use of this method is not to be encouraged, since when pins are driven into the mandible it must be done so with extreme care, because of their possible deleterious effect on the permanent tooth follicles. The anterior portion of the mandible is particularly suitable for insertion of pins when this method is indicated[4] (Fig. 1 *B*, 6 *A* and 6 *B*).

4. In young children, condylar fractures with minimal displacement should be treated conservatively.

Treatment:

1. Maintenance of dental occlusion, usually done for three or four weeks, by means of a light plaster head cast and traction splint supporting the chin. This is made simply by utilizing a heavy muslin cloth connected to a light head cast by means of rubber band traction.

2. Maintenance of condylar fractures for three or four weeks without the use of head cast. This can be accomplished by using a circumferential type of wire around the mandible, inserted through the nasal

spine and the maxilla. This single wire will maintain the teeth in normal occlusion without necessitating additional support.

3. Displaced condylar fractures must be carefully evaluated as to their prognosis and the possibility of growth abnormalities due to any extensive condylar damage. Open reduction and wiring or external pinning is occasionally the treatment of choice when the condylar fragment interferes with normal mandibular motion.

CONCLUSIONS

Fractures of the facial bones in children are relatively infrequent. When they do occur, definitive treatment should be instituted promptly. Certain precautions and principles not usually adhered to with elderly patients should be observed.

1. An appliance or procedure should be kept as simple as possible, in order to restore proper occlusion and function.

2. There should be minimal interference with the deciduous and underlying permanent tooth follicles.

3. Elbow restraints may be necessary to prevent dislodgement of the previously applied oral appliances.

4. Precautions should be taken to allow proper feeding and administration of fluids, regardless of type of appliance used.

SCHLUSSFOLGERUNGEN

Knochenbrüche des Gesichtsschädels kommen bei Kindern verhältnismässig selten vor. Wenn sie auftreten, muss sofort eine energische Behandlung eingeleitet werden. Gewisse Grundsätze der Behandlung und Vorsichtsmassnahmen, die bei älteren Kranken im allgemeinen nicht beachtet werden, müssen innegehalten werden.

1. Die angewandten Verfahren und Apparate sollen möglichst einfach gehalten sein, um eine normale Schlussbissstellung und Funktion wiederherzustellen.

2. Die Milchzähne und die darunter liegenden Zahnsäckchen der bleibenden Zähne sollen so wenig wie möglich angetastet werden.

3. Das Anlegen von immobilisierenden Ellbogenschienen mag notwendig sein, um das Losreissen angewandter Apparaturen im Munde zu verhüten.

4. Welche Art von Mundschienen immer bevorzugt sein mag, muss für die Möglichkeit ausreichender Nahrungs- und Flüssigkeitszufuhr gesorgt werden.

CONCLUSOES

As fraturas dos ossos nazais nas crianças são relativamente raras. Quando ocorrem, o tratamento definitivo deve ser feito imediatamente. Certas precauções e princípios não relacionados com esses acidentes nos adultos devem ser observados.

1. Os métodos de redução devem ser os mais simples possiveis porem devem manter a imobilização e restabelecer as funções.

2. Devem ter interferência mínima com os elementos dentarios já migrados e também com os folículos dentarios ainda retidos.

3. A imobilização do cotovelo poderá ser necessária para evitar que a criança perturbe a fixação das amarrias interdentarias.

4. Devem ser tomadas as medidas adequadas para alimentação de administração de líquidos, seja qual for o tipo de imobilização uzado.

CONCLUSIONI

Le fatture delle ossa facciali nei bambini sono relativamente rare. Quando esse si verificano bisogna iniziare con prontezza il trattamento. Devono osservarsi alcune regole che di solito non si applicano a pazienti più anziani:

1. Ogni tentativo deve essere fatto nel modo più semplice possibile per ottenere una perfetta occlusione e un ripristino completo della funzione.

2. Si deve evitare di ledere i follicoli dentari decidui e i sottostanti permanenti.

3. E' necessario prevenire lo spostamento delle protesi eventualmente applicate.

4. Si deve prendere ogni precauzione per consentire una alimentazione appropriata e una sufficiente somministrazione di liquidi, indipendentemente dal tipo di cura usato.

CONCLUSIONES

Los fractures de los huesos faciales en niños son relativamente poco frecuentes. Cuando llegan a occurrir, métodos definitivos de tratamiento deben instituirse prontamente. Deben observarse ciertas precauciones y principios que usualmente no se aplican en pacientes mayores.

1. Una aplicación o procedimiento debe mantenerse tan simple como sea posible para lograr oclusión y función apropíadas.

2. Debe haber interferencia mínima con los folículos dentarios subyacentes decidurles y permanentes.

3. Puede ser necesario sujetar los codos para evitar el desajuste de aplacaciones orales.

4. Deben tomarse precauciones efectivas para permitir la alimentación apropiada y la administración de fluidos, cualquiera que sea el tipo de aplicación usada.

CONCLUSIONS

Les fractures des os de la face sont relativement rares chez l'enfant. Elles nécessitent un traitement définitif rapide. Chez les malades d'un certain âge il faut tenir compte de certaines précautions et principes trop souvent négligés:

1. Technique, ou appareil orthodontique aussi simples que possible en vue d'une bonne occlusion et d'une fonction satisfaisante.

2. Minimum d'interférence avec les follicules des dens deciduus et des dens permanens.

3. Dispositions afin de prévenir le glissement de l'appareil orthodontique appliqué antérieurement.

4. Précautions à prendre pour l'alimentation et l'administration de liquides, quel que soit le type d'appareil utilisé.

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The newest is but the oldest made visible to our senses. When we dig up the soil from a thousand feet below the surface, we call it and the plants which spring from it, new; and when our vision pierces deeper into space, and detects a remoter star, we call that new also. It had shone only to itself, and quite superior to our observation.

—*Thoreau*

Tuberculous Fistula-in-Ano: Diagnostic Criteria and Current Therapy

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CHICAGO, ILLINOIS

ALL but 3 of the cases cited are from my service in the past thirty years at the City of Chicago Municipal Tuberculosis Hospital, and concomitant pulmonary tuberculosis was present in all. No disease of the lungs or other organs was demonstrated in 3 private cases of tuberculosis and fistula during this period. In the United States, so rarely is tuberculous disease observed at this site without active and often extensive pulmonary lesions that these rarities may be disregarded in this discussion.

General Measures. — At present, management consists of chemotherapy and general supportive therapy for all patients with active pulmonary tuberculosis; pneumotherapy for about 50 per cent, and definitive surgery for about 20 per cent. Pneumothorax has been practically discarded in the past few years because of its complications, which include air embolism, adhesions, empyema and failure to reexpand. Pneumoperitoneum is widely used because of its much greater safety.

For years about 5 per cent of all patients admitted to this hospital had perianal abscess or fistula. In recent years the incidence is 1 per cent or, in some years, less. This is the result chiefly of effective medication instituted before hospitalization. It is desirable, though not always imperative, that such patients be hospitalized in an institution for the tuberculous. The anal or anorectal disease, however, is nearly always merely a complication of the more important pulmonary process. The extent and activity of the pulmonary infection and the type of fistula are determining factors for surgical intervention. A simple, short or superficial fistula does not demand hospital care.

Chemotherapy. — In summary, because tubercle bacilli develop resistance to the drugs under certain circumstances, there are three important principles that must be followed to obtain optimum results. These principles are:

1. At least two of the drugs should be given simultaneously.
2. The drugs should be given continuously. Their administration should not be interrupted throughout the period of treatment.
3. Therapy should be prolonged for many months or even years, so that it will not have to be reinstituted later.

The regimen most commonly used today consists of:

Streptomycin, 1 Gm., given twice weekly by intramuscular injection.
Sodium para-aminosalicylate (PAS), 5 Gm., administered orally three times a day.
Isoniazid, 100-200 mg., administered

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orally three times a day.

Viomycin. Because of its toxicity, this is usually held in reserve for those who become resistant to the other drugs or require it for a limited period, e.g., during operation. The dose is 1 to 2 Gm., administered intramuscularly, twice weekly.

Operation. — Surgical intervention is still necessary in many cases, despite the effective medication of pulmonary disease. The lessened incidence on hospitalization suggests that the primary anorectal infection has been controlled or prevented by medication. Some sinuses are healed by chemotherapy alone, and an occasional fistula may be temporarily healed; the latter, however, tend to recur. These infected tracts vary so much in site, size, number of branching channels, tortuosity and depth that general statements may be misleading. The need of surgical measures has not diminished to such a degree as in some other fields—in mastoid disease, for example. In the general surgical service at the hospital, patients with persisting pulmonary cavities are operated upon after about six months of chemotherapy, when after two or three months serial roentgenograms show little or no change. Patients with active uncontrolled pulmonary disease should not be operated upon. A perianal abscess, of course, will be incised or drained. A short superficial sinus or fistula may be incised but this should be deferred, since the situation is not urgent.

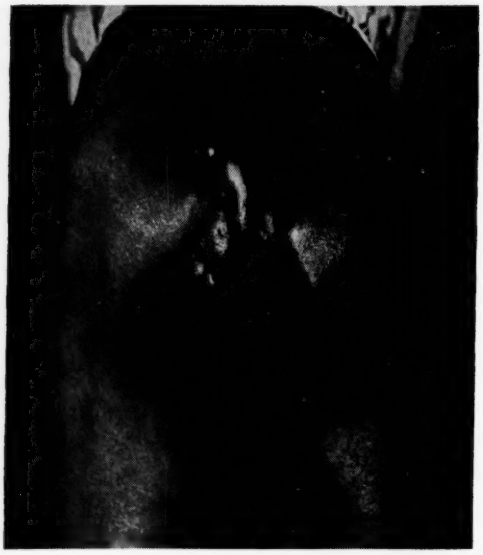

Fig. 1.—Extensive bilateral fistula-in-ano.

Fistulectomy.—As to the exact technic, standard surgical procedures are carried out. The fistula is examined with flexible silver wire probes and, at times, the internal orifice with a crypt hook. Into one of the orifices, usually external, a colored gel or bismuth paste is injected and its exit from other orifices noted. An exact anatomic diagnosis is thus ordinarily obtained. The sphincter is cut at a right angle to the direction of its fibers. When the tract crosses the muscle obliquely a relieving additional short incision may be required to enable the main incision to be made at a right angle to the sphincteric fibers, or as nearly so as possible. Division of the external sphincter in more than one site is avoided, as is extending the incision too high in the bowel wall, thus cutting all the fibers of the internal sphincter. In a word, the usual surgical principles are applied. If the infected tract is short and relatively superficial it may be entirely excised, i.e., a fistulectomy may be done; if it is deeper or if lateral tracts exist, it is incised throughout its length, a fistulotomy being performed. If the latter, the tract is cleaned of granulation tissue. In both, the wound is shaped to assure good drainage; conservative excision of the edges of the skin is often but not always required; elimination of the internal orifice is of paramount importance; both openings are excised. Hemostasis should be exact and complete. A gauze strip is placed in the wound and removed in two or three days;

no further "packing" is used. The patient is allowed to get up when he feels ready, usually on the second to the fourth postoperative day. If continuous bed rest has been ordered this does not apply. The ordinary postoperative measures are used; drawing the finger through the anus every day or two to prevent pocketing or bridging is worth mention.

To epitomize the foregoing comments: Surgical measures are still required in most cases of tuberculous fistula-in-ano. Of first importance is the activity and extent of the pulmonary disease, of which the fistula is merely a complication. The time of operation, except for incision of a perianal abscess, is determined by the activity of the pulmonary disease. In performing a fistulectomy, the standard procedures are used.

CRITERIA FOR DIAGNOSIS

Disagreement exists as to criteria for diagnosis. My experience indicates that the results of histopathologic examination supply the *only* criterion of importance.

It is well known and, in my opinion, a generally accepted fact that a clinical diagnosis founded only on the gross pathologic picture is absolutely undependable, even though the opinion is that of one thoroughly conversant with the lesion. *Not so well known and not so widely accepted* are the real value of histopathologic examination of suspected tissue and the limited reliability of guinea pig inoculation with preparations of tissue excised from the fistulous tract or the wall of the abscess cavity.

The advocates of guinea pig inoculation as the most valuable means of diagnosing tuberculosis in cases of perianal inflammatory and suppurative disease, particularly abscess and fistula, in most instances accept their observations at face value. The fact is there is a large element of error

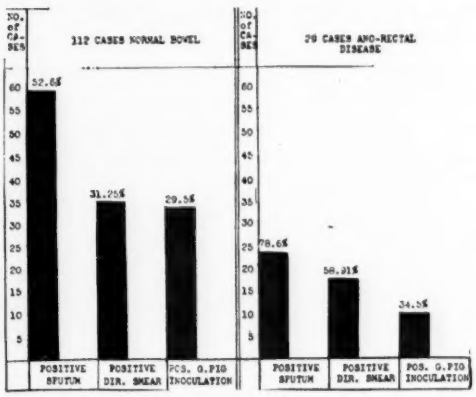

Fig. 2.—Charted observations in 141 of the 200 cases examined.

here that is either unknown or overlooked.

In a study of 200 patients with pulmonary tuberculosis, reported from this service (Fig. 2), it was determined that not only viable but virulent tubercle bacilli were present in the lower portion of the sigmoid and in the rectum in more than 30 per cent. Of patients with anorectal abscess or fistula, 34 per cent had such bacilli present in the last foot of the bowel within an hour after an enema.

In a third of the cases, therefore, tubercle bacilli may enter the rectal or anal orifice (the internal opening) of the fistulous tract. Accordingly, whether the fistula is a tuberculous process or not, tubercle bacilli may be present in it in a third of the cases. At the time the report was published, this large margin of possible error had not been considered in any article on the subject in the current literature. One reason for this is that so little work had been done to determine the incidence of viable tubercle bacilli in the terminal portion of the bowel.

It is absolutely impossible to wash or treat tissue excised or curetted from these fistulous tracts in any way known to bacteriologists, so that contamination of tis-

sue by viable tubercle bacilli can be positively excluded. It is just as difficult as actually sterilizing the skin of the hands. It follows that the use of culture or inoculation to determine the character of a fistula in patients with active pulmonary tuberculosis is partially fruitless, since the results must be qualified by a 30 per cent possibility of error. After positive results have been obtained by either of these methods, the pathologist can make, with accuracy, only the following statement:

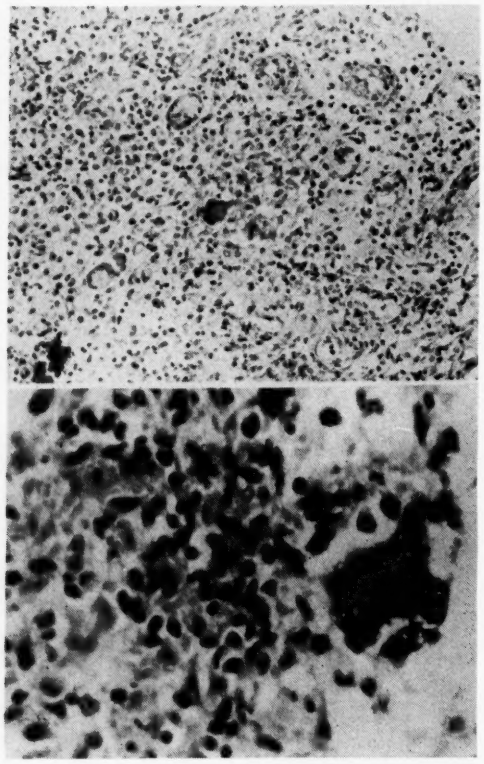

Fig. 3.—*A*, low power view of tuberculous granulation tissue. There is a prominent giant cell in the center, and several capillaries are present, as are several other giant cells. Some glandular structures are noted in the right upper field. *B*, high power photomicrograph of tuberculous granulation tissue. Note the Langhans giant cells on the left, with lymphocytes, epithelioid cells and fibroblasts comprising the remainder of the cellular elements.

"The culture or guinea pig test has given positive results, but it may be wrong, with regard to determining whether or not this is a tuberculous fistula, in at least a third of the cases."

The chief difficulty arises in deciding what to call tuberculous granulation tissue. There is little question about tissue with capillaries, fibroblasts, monocytes and typical horseshoe-shaped Langhans' giant cells. It is when the tissue is atypical that the difficulty is greatest. Upon analysis, however, it is not the problem it may seem. In the first place, most nonspecific abscesses are composed of acutely inflammatory tissue that can be eliminated promptly. Chronically or subacutely inflamed tissue may or may not include tuberculous granulation tissue. In such borderline cases the clinical appearance of the lesions, the clinical history and the bacteriologic observations will help to supplement decision when the lesions are questionable.

Some slides show chronic granulation tissue with a predominance of monocytic cells containing atypical giant cells, but about these there need be little question of a diagnosis.

In others there are chronic granulation tissue and focal necrosis with a predominance of monocytic cells, some of which are arranged in atypical giant cells with 4 to 8 nuclei. They are definitely not due to any false arrangement of the cells of the rectal mucosa, which may at times be confusing.

SUMMARY OF DIAGNOSTIC CRITERIA

The ultimate opinion as to the nature of fistulous lesions of the anal region will be influenced by various factors:

1. The clinical history and appearance of the lesion.

2. The clinical history of active or quiescent tuberculosis, or evidence thereof on roentgen or laboratory examination.

3. The presence or absence of viable tubercle bacilli in the excised lesions as demonstrated by culture or animal inoculation. Here, however, positive results are subject to a 30 per cent error in cases of positive sputum.

4. Tuberculous granulation tissue observed on histopathologic study. This is the most important and the only pathognomonic test when the results are positive.

On a single section this is only positive in about 50 per cent of cases, but when run in serial section is at least 75 per cent efficient. Staining only every third section is usually all that is necessary, and even staining every tenth gives good results.

The absolute figures depend upon the number of the remaining 25 per cent that are nontuberculous. If the results of animal tests or cultures are positive and those of the sputum test are negative, the lesions may be added to those detected by histopathologic examination. If the specimen comes from a positive tuberculous patient the probability is that it is tuberculous, but in the absence of the aforementioned criteria it must be accepted as nontuberculous or held in doubt until proved otherwise by the proper methods.

Author's Note: Acknowledgment is made to M. L. Lichtenstein and Henry C. Sweany, associates at Municipal Tuberculosis Hospital, from whom I have quoted freely.

RESUMEN Y CONCLUSIONES

La opinión acerca de la naturaleza de las lesiones fistulosas de la región anal son dependientes de varios factores:

1. La historia clínica y la aparición de la lesión.

2. La historia clínica de tuberculosis activa o apagada, o evidencia de la misma for exámenes radiológicos o de laboratorio.

3. La presencia ó ausencia del bacilo tuberculoso viable en las lesiones extirpadas demostrado por cultivo ó por inoculación animal. Aquí, sin embargo, los resultados positivos están sujetos a 30 por ciento de error en caso de esputo positivo.

4. Tejido de granulación tuberculoso observado en estudios histopatológicos. Este es el test mas importante y el único patognomínico cuando los resultados son positivos.

En un corte único solo es positivo en cerca del *50 por ciento* de casos, pero cuando se hacen cortes *seriados* es por lo menos *75 por ciento* eficiente. *Generalmente es suficiente* teñir *uno de cada tres cortes* y aún tiñendo *uno de cada diez se logran buenos resultados.*

Las cifras absolutas dependen del número de casos no tuberculosos incluidos en el 25 por ciento restante.

Si los animales ó los cultivos son positivos y el esputo es negativo, esos casos pueden sumarse a los encontrados por examen histopathológico.

Si los especímenes provienen de un paciente tuberculoso positivo la probabilidad es que sea tuberculoso, pero en ausencia del criterio mencionado las lesiones deben aceptarse como no tuberculosas ó mantenidas en duda hasta que se demuestre lo contrario con métodos apropiados.

RÉSUMÉ ET CONCLUSIONS

Une opinion décisive quant à la nature des lésions fistuleuses de la région anale sera influencée par divers facteurs:

1. Anamnèse clinique et aspect de la lésion.

2. Anamnèse clinique d'une tuberculose en activité ou latente, ou évidence radiologique ou bactériologique de tuberculose.

3. Présence ou absence de bacilles tuberculeux actifs dans la lésion excisée, démontrée par la culture in vivo ou in vitro. Là cependant des résultats positifs sont sujets à erreurs dans 30% des cas avec crachats tuberculeux.

4. Granulation tissulaire tuberculeuse observée lors de l'examen histopatholo-

gique. Ce symptôme est *le plus important* et le seul test *pathognomonique* en cas de résultats positifs.

Avec une seule coupe ce test n'est positif que dans *50%* des cas, mais il est positif dans au moins *75%* des cas lors de *coupes en séries. Il suffit habituellement* de colorer *une coupe sur trois;* l'on obtient même de *bons résultats* avec *une coupe sur dix.*

Les chiffres absolus dépendent du nombre des 25% restants qui ne sont pas tuberculeux. Les cas où l'animal ou les cultures sont positifs avec crachats négatifs, peuvent être ajoutés à ceux trouvés par l'examen histopathologique. Si les spécimens proviennent d'un malade à tuberculose positive il est probable qu'ils seront tuberculeux, mais en l'absence du critère mentionné plus haut les lésions doivent être considérées comme non tuberculeuses, ou bien il faut conserver un doute jusqu'à ce que le cas soit confirmé par les méthodes indiquées.

ZUSAMMENFASSUNG UND SCHLUSSFOLGERUNGEN

Die endgültige Entscheidung über die Art von Fisteln in der Aftergegend wird durch folgende Faktoren beeinflusst:

1. Krankheitsgeschichte und klinische Erscheinung der Erkrankung.

2. Vorgeschichte oder Röntgennachweis oder Laboratoriumsbefunde einer aktiven oder ruhenden Tuberkulose.

3. Nachweis oder Ausschluss lebensfähiger Tuberkelbazillen durch Kulturen oder Tierversuche in dem herausgeschnittenen kranken Gewebe. Hier kommt es allerdings zu Irrtümern in 30 Prozent von positiven Ergebnissen, wenn die Sputumuntersuchung positiv ist.

4. Beobachtung tuberkulösen Granulationsgewebes bein histopathologischer Untersuchung. Dies ist im positiven Falle die *wichtigste* und die einzige *pathognomonische* Untersuchung.

Wenn nur ein Schnitt untersucht wird, gelangt man zu etwa *50 Prozent* positiven Fällen, macht man jedoch *Serien*schnitte, erreicht man mindestens *57 Prozent. Man braucht gewöhnlich nur jeden dritten Schnitt* zu färben, und sogar die Färbung jeden *zehnten Schnittes ergibt gute Resultate.*

Die absoluten Zahlen hängen von der Anzahl der verbleibenden 25 Prozent ab, die nicht tuberkulös sind. Die Fälle, bei denen das Sputum negativ, aber der Tierversuch oder die Kulturen positiv sind, können zu denen mit positiver histopathologischer Untersuchung hinzugefügt werden. Wenn die Präparate von einem positiv tuberkulösen Kranken stammen, so besteht die Wahrscheinlichkeit, dass es sich um eine tuberkulöse Veränderung handelt, beim Fehlen der oben erwähnten Kriterien, jedoch muss die Veränderung als nicht tuberkulös oder als zweifelhaft angesehen werden, solange kein gegenteiliger Beweis durch geeignete Methoden geliefert ist.

RIASSUNTO E CONCLUSIONI

Riguardo alla natura delle lesioni fistolose della regione anale l'ultima opinione è che esse siano influenzate da diversi fattori:

1. La storia clinica e il primo apparire della lesione.

2. La storia clinica o radiografica o di laboratorio di una tubercolosi attiva o latente.

3. La dimostrazione con la coltura o la inoculazione in animali della presenza o assenza di bacilli tubercolari nella lesione. Bisogna notare che si ha il 30% di errori nei casi di sputo positivo.

4. L'osservazione, con lo studio istopatologico, di tessuto di granulazione tubercolare; è questo, quando i risultati siano positivi, *l'unico esame patognomonico* ed *il più importante.* Nelle singole sezioni esso è positivo solo nel 50% dei casi, ma

nelle sezioni in serie è positivo nel 75%.

E' sufficiente colorare una sezione ogni tre o anche una ogni 10. Se l'animale o le colture sono positive e lo sputo è negativo questi casi devono essere uniti a quelli stabiliti con gli esami istopatologici. In assenza di questi criteri la lesione deve essere considerata come non tubercolare o almeno lasciata in dubbio fino a che non venga provato il contrario.

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Extensive Cicatricial Stenosis of the Esophagus: Treatment by Retrosternal Transposition of the Colon

Report of Five Cases

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THE surgical treatment of cicatricial stenosis of the esophagus began in 1896, at which time Bircher carried out the first esophagoplasty by forming a presternal skin tube. Owing to the advances in surgery since then, many new procedures have been tried in an effort to select the most appropriate.

Simultaneously, much progress has been achieved in conservative treatment of cicatricial stenosis. Nevertheless there remain many cases in which the condition either does not respond or recurs after treatment.

For replacing the constricted segment of the esophagus various methods have been proposed, such as the formation of a presternal tube or transposition of the stomach, the small intestine or the colon presternally, retrosternally or intrathoracically.

At present the skin tube is rarely used.

Transposition of the stomach into the left thoracic cavity, which was performed by Kirschner in 1920 and later by other surgeons, presents many technical difficulties, the principal one of which is to obtain a gastric tube sufficiently long, owing to the gastric fibrosis following the action of the corrosive liquid. Vladislas and Hronada, after reporting 2 successful operative cases in 1950, insist on the gravity of this operation and the frequency of complications, even in cases in which anastomosis to the proximal portion of the esophagus is done beneath the aortic arch. Another technic of subcutaneous transposition of the stomach was described by Lortat and Jacob in 1949.

In 1911 Roux proposed utilization of a jejunal loop to replace the scarred esophagus. This procedure was later often repeated by other surgeons (Schumaker, Battersby, Makkas, Judine, Froelich and Dantlo, Reeve, Thomas and Copinath). It is not always possible, however, to mobilize a sufficient length of small intestine without incurring the danger of necrosis. In a series of 88 cases thus managed by Judine, direct anastomosis of the jejunum to the cervical portion of the esophagus was possible in only 20 per cent of the cases.

At present, most surgeons, in treating cicatricial stenosis, transpose the colon. This procedure was introduced by Kelling (1911), Thorek (1913) and von Hacker

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(1914). Opinions differ as to the comparative advantages of transplanting the right, the left or the transverse portion of the colon.

Transposition of the right half presupposes preservation of the right colic artery to insure the blood supply of the mobilized segment. Anatomic anomalies of this vessel may therefore preclude the application of this method. The mobilized segment of the right half of the colon comprises the terminal portion of the ileum, the cecum and the ascending and part of the transverse portions. In the opinion of many authors (Kelling, Thorek, Roith, Godarad, Edelman, Denoix, Makkas, Kourias, Ruddle, Dufour, Lafargue, Lortat-Jacob, Magnant), utilization of the right half of the colon is the method of choice, because the technic of mobilization does not differ from that of the typical right colectomy and because this type of transplantation is isoperistaltic.

The authors who, on the other hand, recommend the use of the left or the transverse portion of the colon (Wulliet, Orsoni, Lemaire, Toupet, Goligher, Robin) insist that mobilization is easier by this method and a better blood supply is obtained. This last assumption is founded on a study by Toupet, which demonstrated that an adequate blood supply of the left and transverse portions of the colon is insured if the right colic artery is preserved. As to functional troubles due to antiperistaltic transposition of the colon, these, in the opinion of the aforesaid authors, are of minor importance.

Transposition of the colon can be effected in the following ways: (1) presternally, under the skin; (2) intrathoracically, through the right or the left pleural space, or (3) retrosternally, through the anterior mediastinum. In the last-mentioned procedure, as described by Robertson, the mediastinal organs are bluntly separated from the sternum in order to create a tunnel for pulling through one end of the mobilized colon. Anastomosis of the upper end of the colon to the cervical portion of the esophagus can be performed either in one stage (Ruddle and others) or in two. The lower end of the isolated colon is anastomosed with the stomach or with the jejunum.

In all of my cases the colon was used to reconstruct the esophagus. In 4 cases the right half (terminal portion of the ileum, cecum, ascending and part of the transverse portion of the colon), and in 1 case the transverse portion, with a segment of the descending portion, was used.

In the last-mentioned case I observed an anomaly of the right colic artery, the superior branch of which was undeveloped. The blood supply to the right half of the colon was provided by the right branch of the middle colic artery, which extended to the cecum. In the other 4 cases the right half of the colon was pedicled on the right colic artery.

The one end of the mobilized colon was brought up to the left cervical region through a retrosternal tunnel. The other end of the isolated loop was anastomosed to the stomach. To restore the continuity of the intestinal tract, an ileotransverse side-to-side anastomosis was done in 4 cases and a side-to-side colocolostomy of the ascending with the sigmoid portion of the colon in 1 case. At a second stage the ileum (4 cases) or the transverse portion of the colon (1 case) was united end to side with the transected proximal end of the cervical portion of the esophagus.

In performing transposition of the colon it is highly important to mobilize a sufficient length of intestine, provided with an adequate blood supply. It is advisable, therefore, to measure the distance from neck to stomach before completing mobilization. Another detail is preservation of the inferior thyroid artery (which supplies a branch to the esophagus), as

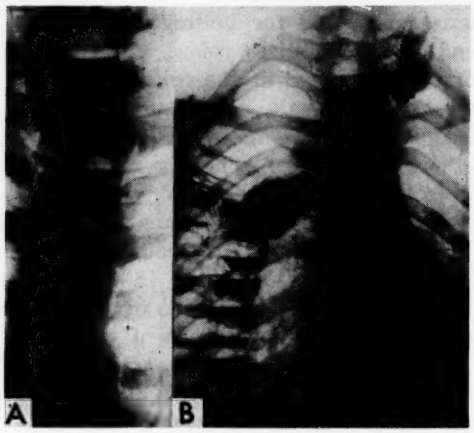

Fig. 1 (Case 1).—*A*, stricture of esophagus beginning at sixth cervical level. *B*, roentgenogram showing satisfactory swallowing mechanism in transplanted colon.

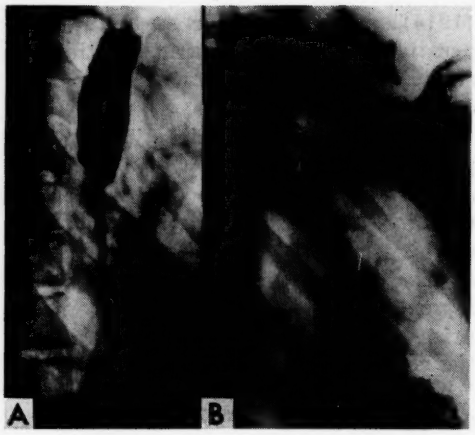

Fig. 2 (Case 2).—*A*, extensive stricture of thoracic portion of esophagus. *B*, roentgenogram showing good postoperative function (see text).

well as preservation of all esophageal blood vessels, to prevent necrosis of the esophageal stump after anastomosis.

In my opinion, the use of the right half of the colon for reconstructing the scarred esophagus should be preferred, for the following reasons: (1) because the transplantation is isoperistaltic and (2) because the continuity of the intestinal tract is reestablished by a typical ileotransversostomy, whereas in transposition of the left half of the colon or the transverse portion a colocolonic anastomosis must be performed, and this is followed by a higher mortality rate.

Retrosternal transposition, as compared with transpleural reconstruction of the esophagus, presents the advantage of not being attended by pleural complications. As compared with subcutaneous presternal transposition, it has the advantage of requiring a lesser length of colon.

I am also convinced of the advantage of postponing the ileoesophageal anastomosis, performing it in a second stage, because this permits alimentation by means of a rubber tube introduced into the stomach through the cervical ileostomy. Gastrostomy therefore becomes superfluous. There is also less danger of dehiscence if anastomosis with the esophagus is performed in a second stage, because the blood supply of transplanted colon is given the necessary time to readjust.

REPORT OF CASES

CASE 1.—The patient, a woman aged 20, stated that six months earlier she had swallowed sulphuric acid by mistake, whereupon cicatricial stenosis of the esophagus had developed. She was treated by bougienage, without appreciable results. On admission here she was able to swallow liquids. Her weight was 38 Kg. Roentgenograms demonstrated an extensive stricture of the esophagus, beginning from the sixth cervical level (Fig. 1*A*). The first operation was performed on Nov. 24, 1954. A midline laparotomy was done. An anomaly of the colic artery was present, precluding mobilization of a sufficient length of the colon, if pedicled on this vessel. The right branch of the middle colic artery, however, provided an adequate blood supply for the right half of the colon, so that the right colic artery could be sacrificed. The ileum was transected 10 cm. orad to the ileocecal valve. Appendectomy was done. The cecum, the ascending portion of the colon and the hepatic flexure were mobilized. Transection of the transverse and

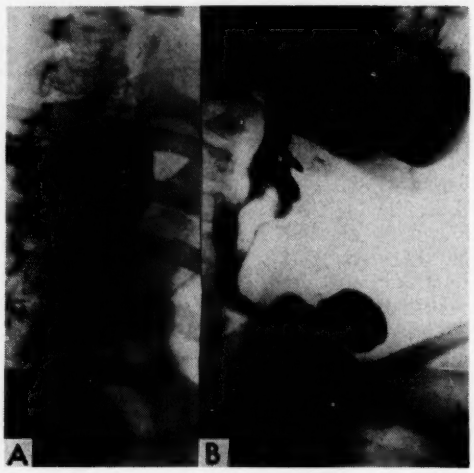

Fig. 3 (Case 3).—*A*, severe corrosive stricture of esophagus due to ingestion of potash. *B*, roentgenogram showing rapid emptying of transplanted colon.

ileotransverse anastomosis was done to restore the continuity of the intestinal tract. Retrosternal blunt dissection of the anterior portion of the mediastinum from the xiphoid to the neck was performed, and an incision was made on the anterior border of the left sternomastoid. The proximal end of the isolated loop of the colon was brought up to the neck, where an ileostomy was performed. The distal end of the loop of colon was implanted end to side in the stomach. The abdomen was closed.

From the fourth postoperative day the patient was fed by means of a catheter introduced into the stomach from the cervical ileostomy. On the twentieth day the cervical portion of the esophagus was transected above the constricted portion, and an end-to-side anastomosis to the ileum was performed. The aboral end of the esophagus was partially sutured and drained by means of a tube. Feeding was continued through the ileostomy for ten more days, after which the catheter was withdrawn and the ileostomy closed.

Roentgen examination demonstrated a satisfactory functional swallowing mechanism in the transplanted colon (Fig. 1*B*). Twenty days after the second intervention the patient was discharged, with a gain in weight of 8 Kg.

CASE 2.—A woman aged 18 stated that three months earlier she had drunk sulphuric acid by mistake. Cicatricial stenosis of the esophagus followed and was treated by bougienage, without result. The patient could swallow liquids in small quantities. On admission she had lost 12 Kg. in weight. Roentgenograms showed an extensive stricture of the thoracic portion of the esophagus, beginning at the height of the sternoclavicular joint (Fig. 2*A*).

The first operation was performed on Sept. 29, 1955. The same procedure was applied as in Case 1, with the difference that the right colic artery was in this case well developed and could be used as the vascular pedicle of the mobilized right half of the colon. Retrosternal transposition of the loop was performed, with left cervical ileostomy and implantation into the stomach of the lower end of the colon. Intestinal continuity was reestablished by ileotransverse anastomosis. Food was given by means of a rubber tube introduced into the stomach from the ileostomy. At a second stage, twenty days later, side-to-end anastomosis of the ileum to the transected esophagus was done. The ileostomy was closed a month after the first intervention.

Roentgenograms demonstrated good function of the transplanted colon (Fig. 2*B*). The patient was discharged forty days after the first operation, having gained 8 Kg. in weight.

CASE 3.—A woman aged 19 stated that six months prior to admission she had swallowed potash, which produced a severe corrosive stricture of the esophagus. Conservative treatment was considered unpromising. Only small

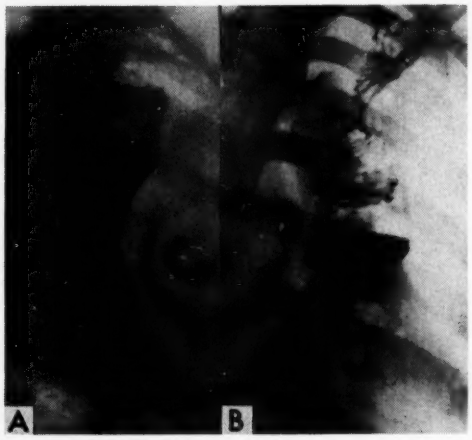

Fig. 4 (Case 4).—*A*, total obstruction of thoracic portion of esophagus beneath fifth dorsal level. *B*, barium roentgenogram showing satisfactory swallowing mechanism.

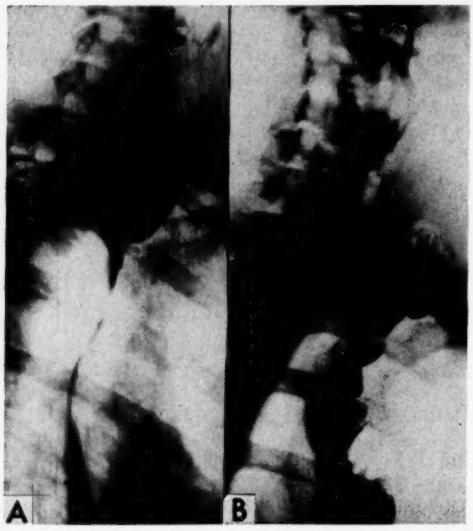

Fig. 5 (Case 5).—*A*, severe corrosive stricture of esophagus due to ingestion of potash, with extensive cicatrical stenosis beginning at third dorsal level. *B*, barium study of reconstructed esophagus, showing satisfactory functional result.

quantities of liquid could be swallowed (Fig. 3*A*). The patient had lost 10 Kg. in weight.

The first intervention took place on March 9, 1956. The right half of the colon was mobilized as in the preceding case; retrosternal transposition, cervical ileostomy and gastrocolostomy of the distal end of the isolated loop were performed, with ileotransverse anastomosis to restore continuity of the intestine. Postoperatively the patient was fed by means of a catheter through the ileostomy. After twenty days, the transected esophagus was anastomosed end to side to the ileum. Feeding through the ileostomy was continued for ten days, after which the stoma was closed. Roentgen control showed rapid emptying of the transplanted colon (Fig. 3*B*). The patient was discharged twenty days after the second operation, having gained 6 Kg. in weight.

CASE 4.—A woman 22 years old, ten days before admission, took sulphuric acid. In order to nourish her, a gastrostomy had been performed in another hospital. Roentgenograms showed total obstruction of the thoracic portion of the esophagus beneath the fifth dorsal level (Fig. 4*A*). On admission the loss of weight amounted to 14 Kg. The first surgical intervention took place on March 25, 1956. A midline laparotomy was done. The right colic artery was short and displaced toward the cecum. For this reason the transverse portion of the colon, together with the splenic flexure and a part of the descending portion, was mobilized. The blood supply of the isolated loop was provided by the middle colic artery. The continuity of the intestinal tract was reestablished by end-to-end anastomosis of the ascending portion of the colon with the sigmoid. Retrosternal transposition and left cervical colostomy of the distal end of the isolated loop were performed. The proximal end was implanted into the stomach after closure of the gastrostomy. Alimentation was insured by means of a tube introduced into the stomach from the colostomy. After twenty-two days the proximal end of the transected esophagus was anastomosed end to side to the colon, and ten days later the colostomy was closed.

In the beginning there were slight disturbances of deglutition, due to the antiperistaltic transposition. Later, however, barium studies showed a satisfactory swallowing mechanism (Fig. 4*B*). When discharged, twenty days after the second intervention, the patient had gained 7 Kg. in weight.

CASE 5.—A man aged 21 had severe corrosive stricture of the esophagus, due to the ingestion of potash one year before admission to the hospital. Dilatation of the stricture was never attempted, owing to its severity. Roentgenographic study revealed extensive cicatricial stenosis, beginning from the third dorsal level (Fig. 5*A*). The patient was able to swallow liquids only and had lost 10 Kg. in weight.

The first operation was performed on Sept. 9, 1956. A midline laparotomy was done. In the absence of any vascular anomaly, a typical mobilization of the right half of the colon was carried out, pedicled on the right colic artery. Retrosternal transposition, left cervical ileostomy and gastrocolostomy were then performed. The continuity of the intestinal tract was restored by an ileotransverse anastomosis. Food was given by means of a rubber tube introduced into the ileostomy. After an interval of twenty days the transected upper end of the esophagus was implanted end to side into the ileum. The ileostomy was closed ten days later. Barium studies of the reconstructed esophagus demonstrated a most satisfying functional result (Fig. 5*B*). At discharge, twenty days after the second intervention, the patient had gained 5.5 Kg.

SUMMARY AND CONCLUSIONS

Five cases are reported of extensive cicatricial stenosis of the esophagus, treated during the past two years by retrosternal transposition of an isolated colonic loop. In 4 cases the right half of the colon and the terminal portion of the ileum were transplanted; in 1 case, the transverse portion of the colon, together with the splenic flexure. Reestablishment of the continuity of the intestinal tract was effected in 4 cases by an ileotransverse anastomosis and in 1 case by a colocolonic anastomosis of the ascending with the sigmoid portion of the colon. One end of the isolated loop of colon was implanted into the stomach (in 4 cases in conformity with peristalsis and in 1 case contrary to it). The other end was brought up to the left cervical region, where in 4 instances an ileostomy was performed and in 1 a colostomy of the descending portion of the colon. Ileostomy or colostomy was used to feed the patient, a rubber tube being introduced into the stomach during the stages of reconstruction. At a second stage an end-to-side anastomosis of the transected cervical portion of the esophagus with the ileum or the colon was carried out, and at a third stage the ileostomy was closed. All patients were discharged with satisfactory functional results and with notable gains in weight. Retrosternal transposition through the anterior portion of the mediastinum presents many advantages, such as the absence of pleural complications and the fact that it requires a lesser length of mobilized colon than does subcutaneous transposition. Replacement of the esophagus by the right half of the colon is regarded as the method of choice, because of the isoperistaltic transposition. Anomalies of the right colic artery may eventually preclude utilization of the right half of the colon, however, in which case the transverse or the left portion should be transplanted in preference to the small intestine.

RIASSUNTO E CONCLUSIONI

Vengono riferiti 5 casi di estese stenosi cicatriziali dello esofago trattate, negli ultimi due anni, con la trasposizione retrosternale di un'ansa isolata del colon. In 4 casi furono trapiantati la metà destra del colon e la porzione terminale dell'ileo; in 1 caso fu trapiantato, invece, il colon trasverso con la flessura splenica. La continuità del tratto intestinale fu ristabilita in 4 casi con un'anastomosi ileotrasversa e in un caso con un'anastomosi colocolica dell'ascendente con la porzione sigmoidea del colon. Una estremità dell'ansa isolata venne impiantata, in 4 casi, nello stomaco in senso isoperistaltico ed in 1 caso in senso contrario. L'altra estremità fu inserita alla regione cervicale dove, in 4 casi un ileostomia o colostomia servì ad alimentare il paziente, dopo che durante la fase ricostruttiva, gli era stato introdotto un tubo di gomma nello stomaco. In un secondo momento si praticò un'anastomosi terminolaterale della porzione cervicale dell'esofago con l'ileo o il colon; e in un terzo stadio si chiuse l'ileostomia. Tutti i pazienti vennero dimessi con ottimi risultati dal punto di vista funzionale e tutti notevolmente aumentati di peso.

La trasposizione retrosternale attraverso il mediastino anteriore presenta molti vantaggi quali l'assenza di complicazioni pleuriche e un tratto di colon mobilizzato minore di quello richiesto nella trasposizione sottocutanea. La sostituzione dell'esofago con il colon destro è il metodo d'elezione data la trasposizione isoperistaltica. Può verificarsi che un'anomalia dell'arteria colica destra precluda l'utilizzazione del colon destro, ed in tal caso si preferisce l'utilizzazione del colon sinistro o trasverso.

ZUSAMMENFASSUNG UND SCHLUSSFOLGERUNGEN

Es wird über fünf Fälle berichtet, die innerhalb der letzten zwei Jahre wegen umfangreicher narbiger Verengung der Speiseröhre mittels retrosternaler Einpflanzung einer isolierten Dickdarmschlinge behandelt wurden. In vier Fällen wurde die rechte Hälfte des Dickdarms mit der Endschlinge des Ileums, in einem Falle der Querdarm mit der Flexura lienalis transplantiert. Die Kontinuität des Darmkanals wurde in vier Fällen durch eine Ileotransversostomie und in einem Falle durch eine Anastomosierung des aufsteigenden Dickdarms mit dem Sigmoideum wiederhergestellt. Das eine Ende der isolierten Dickdarmschlinge wurde in den Magen eingenäht, und zwar in vier Fällen in Richtung der Peristaltik und in einem Falle in entgegengesetzter Richtung. Das andere Ende der isolierten Dickdarmschlinge wurde in die Halsgegend verlegt, wo in vier Fällen eine Ileostomie oder eine Kolostomie zur Ernährung des Kranken benützt wurde; während der verschiedenen Stadien der Behandlung wurde ein Gummirohr benützt, das in den Magen eingeführt war. In einer zweiten Sitzung wurde eine End-zu-End-Anastomosierung des durchschnittenen Halsabschnittes der Speiseröhre mit dem Ileum oder dem Kolon ausgeführt, und in einer dritten Sitzung wurde die Ileostomie geschlossen. Alle Kranken wurden mit befriedigenden funktionellen Resultaten und mit einer bemerkenswerten Zunahme an Gewicht entlassen.

Die retrosternale Verlagerung des Darmes durch das vordere Mediastinum bietet viele Vorzüge wie z. B. das Ausbleiben von Komplikationen seitens des Rippenfells und die Tatsache, dass die Mobilisierung einer kürzeren Kolonschlinge ausreicht, als die subkutane Verlagerung erfordert. Die rechte Hälfte des Dickdarms eignet sich am besten als Speiseröhrenersatz wegen der isoperistaltischen Verlagerung. Anomalien der rechten A. colica können allerdings die Verwendung des rechten Dickdarms unmöglich machen. In diesen Fällen ist eine Transplantation des Querdarms oder des linken Kolons einer Dünndarmtransplantation vorzuziehen.

RÉSUMÉ ET CONCLUSIONS

L'auteur décrit cinq cas de sténose cicatricielle étendue de l'oesophage, traités durant ces deux dernières années par transposition rétrosternale d'une anse colique isolée. Dans 4 cas l'auteur a transplanté la moitié droite du colon et la portion terminale de l'iléon; dans 1 cas, le colon transverse avec l'angle splénique. La continuité du tractus intestinal a été rétablie dans 4 cas par une anastomose iléotransverse, dans 1 cas par une anastomose colo-colique de la portion ascendante avec la portion sigmoide du colon. Une extrémité de l'anse du colon a été implantée dans l'estomac dans 4 cas dans le sens du péristaltisme, dans 1 cas dans le sens contraire. L'autre extrémité a été amenée vers la région cervicale; dans 4 cas les malades ont été nourris par une iléostomie ou une colostomie (tube de caoutchouc introduit dans l'estomac durant les différents stades de la reconstruction). Lors d'un second temps, anastomose bout à bord de la portion cervicale disséquée de l'oesophage avec l'iléon ou le colon; troisième temps: fermeture de l'iléostomie. Tous les malades ont quitté l'hôpital dans un état fonctionnel satisfaisant, avec une augmentation de poids notable.

La transposition rétrosternale à travers le médiastin antérieur présente de nombreux avantages, tels que l'absence de complications pleurales et le fait qu'elle nécessite un fragment plus court de colon mobilisé que la transposition sous-cutanée. La remise en place de l'oesophage par le

colon droit est considérée comme la méthode de choix, en raison de la transposition iso-péristaltique. Les anomalies de l'artère colique droite peuvent éventuellement empêcher l'utilisation du colon droit; dans ce cas le transverse ou le colon gauche peuvent être transplantés, de préférence à l'intestin grêle.

RESUMEN Y CONCLUSIONES

Se reportan cinco casos de estenosis cicatricial extensa del esófago tratada por transposición retro-esternal de un asa aislada de colon, durante los últimos dos años. En 4 casos la mitad derecha del colon y la porción terminal del íleon fueron trasplantadas; en un caso el colon transverso con el ángulo esplénico. El restablecimiento de la continuidad del tracto intestinal se efectuó en 4 casos por una anastomosis íleo transversa y en 1 caso por una anastomosis colo-cólica, de la porción ascendente del colon al sigmoide. Un extremo del asa aislada de colon se implantó en el estómago en 4 casos, en forma isoperistáltica, y en un caso en forma antiperistáltica. El otro extremo se llevó a la región cervical, en 4 casos se alimentó al paciente, a través de una ileostomía ó colostomía, introduciéndose un tubo de hule en el estómago durante los tiempos de la reconstrucción. En un segundo tiempo una anastomosis término-lateral de la porción cervical seccionada del esófago con el íleon ó con el colon se llevó a cabo y en un tercer tiempo se cerró la ileostomía. Todos los pacientes fueron dados de alta con resultados funcionales satisfactorios y con notable aumento de peso.

La transposición retroesternal a través del mediastino anterior presenta muchas ventajas tales como la ausencia de complicaciones pleurales y por el hecho de que requieren menor longitud de colon movilizado que la transposición subcutánea. El reemplazo del esófago por el colon derecho se considera el método de elección para la transposición isoperistaltica. Las anomalías de la arteria cólica derecha pueden eventualmente impedir el uso del colon derecho en cuyo caso el colon transverso, ó el colon izquierdo pueden trasplantarse, siendo estos preferibles que el intestino delgado.

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The noise of the mill is heard by many; the flour is seen by few.

Editorial

Surgeons and the Rise of Anatomy

AT first glance, the title "Surgeons and the Rise of Anatomy" simply appears to imply the following question: How did the rise of anatomy influence surgery? On closer analysis, however, this question leads to a set of other questions which must be answered before my subject becomes truly meaningful. These questions are: How could there have been any surgery before the rise of anatomy? Was there any earlier surgery? Why can we only now, in the fifth lecture on the history of surgery, talk about the rise of anatomy?

Some of the answers to these questions were inherent and explicit in the preceding lectures, others I must give to set the stage for the period and events with which I shall deal here.

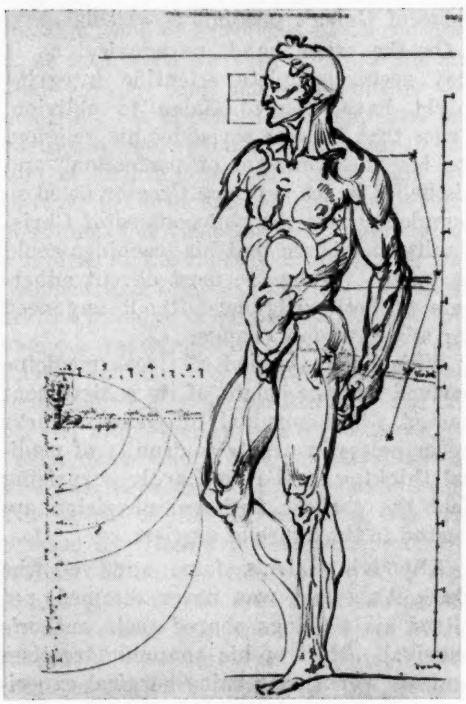
It is evident that some form of surgery has been practiced since the infancy of mankind. It is equally evident that most of this surgery related to wounds and accidents, that it was restricted to the setting of fractures, the application of splints, the reduction of dislocations and the closing of wounds. The methods for these operations were dictated by primitive logic and developed and perfected by practice. All the surgeon did was repair lesions; he did not produce new ones in the pursuit of his profession. It is perhaps true that many of these surgical manipulations might have been carried out more speedily or skillfully had the surgeon been consciously familiar with the structure of the human body. As it was, familiarity with the surface anatomy of the human body came with practice and experience, and things hidden were neither studied nor operated upon. It was obvious that not only the skill but even the incentive for more than restorative surgical intervention was lacking for many centuries. Surgeons and laymen alike realized early that wounds that penetrated the abdominal or the thoracic cavity or the head were almost invariably followed by death, and if we remember Dr. Zimmerman's lecture,* and his discussion of the Edwin Smith Surgical Papyrus, we are aware that when such wounds occurred, the surgeon would either decline to treat them, or, at best, adopt an expectant, noninterfering attitude. If surgeons were unwilling or unable to intervene in cases of internal injury, they were even less willing or able to cause internal injury in order to abolish pain, the origin of which was unknown to them.

In view of man's early interest in the study of man and in view of the early and inevitable development of a medical art, one must wonder why it was not natural for the physicians of antiquity to study the structure of the human body and why for two thousand years, with few exceptions, the healing arts—medicine and surgery—were practiced without knowledge of human anatomy.

Lecture given at the International Surgeons' Hall of Fame on Dec. 4, 1956, in the series offered by the School of the History of Surgery and Allied Sciences of the International College of Surgeons.

*Bulletin, January, 1957.

It must be realized that in the early days of medicine there were two types of healer: the priest, whose ministrations called upon divine intervention, and the medical craftsman, whose interest was restricted to visible lesions, without concern for the causes of disease and the inner workings of the body. All questions related to hidden causes and hidden structures were considered philosophic rather than medical, and for centuries the medical man never arrogated unto himself the status of philosopher. It was only in the third century B.C. and for less than five hundred years that the transformation from craftsman to philosopher took place, but with the end of antiquity the physician, and particularly the surgeon, shed this uncomfortable garb of the philosopher and reverted to craftsmanship, while the priests resumed their function as supernatural healers.



Male figure after pen-and-ink sketch by Michelangelo, 1474-1564.

Curiously enough, the invasion of medicine by philosophy came by way of human anatomy, which, after the first century of our era, was condemned as the least philosophic and therefore the most neglected of all medical disciplines.

Until the time of Hellenistic, or Alexandrian, medicine, the study of human anatomy had not entered the realm of the Greek physician. The sculptures of Praxiteles reveal that the ancient Greeks were observant of the surface anatomy of the human body, but the study of internal anatomy had been left to chance observations, such as were offered by the occasional sight of a severely wounded gladiator, and was not pursued as a course of medical training. According to the views of the Hippocratic physician, further knowledge of the structure of the human body was not necessary, since it could be inferred from the study of animals.

The philosophers of the period went even further than the physicians in their analogic statements and arrived at conclusions that show a striking similarity to those of the early Chinese thinkers. Everything in the universe, they reasoned, was of the same composition as the universe itself; hence conclusions about the nature of the universe could be applied to all its creatures, and thus also to man. Aristotle challenged the principle of analogic deductions, stating that metaphors, while useful in poetry, were unsatisfactory as scientific theories.

Important as was the refusal of Aristotle and Theophrastus to make inferences from the structure of the animals and apply them to that of man, it was not by itself sufficient to help the Greeks overcome their inherent distaste for dissection of the cadaver, for until the fourth century B.C. the Greeks shared the belief of many ancient peoples that the human body

housed the soul and should remain inviolate even after death. In the 4th century B.C., however, Plato destroyed this belief. In his dialogue "Phaidon" the condemned Socrates comforts his friends about his death and burial and assures them that corpses are but images of the dead, and that the real self, the immortal soul, departs to the presence of the gods. Aristotle and, later, Epicurus adopted these Platonic theories, and a new general attitude toward life and death was thus created. Dissection of the human body ceased to be anathema to the philosopher, and thus the study of human anatomy became possible.

Unlike the earlier physicians of the Hippocratic period, the Hellenistic physicians were disciples of philosophers. The medical craftsman was replaced by the philosopher, because only as a philosopher could the physician achieve a new approach to the problem of a casual explanation of disease. The priest-healer took for granted the idea that disease was the expression of divine power; the medical craftsman followed the concept of disease as dysfunction of a mechanical law; but when the philosophers became practicing physicians they realized that disease was directly related to the structure of the human body. With the search for casual explanations, as expressed in the study of anatomy and physiology, the physician had become a scientist and thus a philosopher —for science formed the basis of philosophy.

Galen, who lived in the second century A.D. was the last to combine the art of medicine and surgery with the scientific search for the causes of disease and the study of anatomic structures.

Yet it was neither his brilliant philosophy nor his superb craftsmanship that commended Galen to posterity and helped him dominate the medicine of the Middle Ages. As Charles Singer has pointed out, the reverence shown to Galen by the medieval world is largely due to his teleologic beliefs. Galen's religion of teleology was based upon the Aristotelian principle that "Nature does nothing in vain." With this dictum Galen justified the form and structure of every organ in relation to the function for which he thought it designed. In doing this, he claimed that in every work of Creation—thus, also, in man's body—it was possible to demonstrate the Creator's design along known principles. To the Stoics of Galen's era, determinism in itself was neither novel nor strange. But Galen's determinism was a "determinism of perfection," in which everything was arranged by a wise and far-seeing Creator and was, accordingly, perfect. Such beliefs naturally interfered with accurate description of the body and its functions and marred the scientific value of Galen's prodigious writings.

On the other hand, paradoxical as it may seem, complete scientific integrity might have doomed Galen to oblivion. From that he was saved by his religion, for his "determinism of perfection" and his belief in the supreme Creator fitted so completely into the philosophies of Christianity and Islam that his teachings could be taken over by the most devout adherents of both religions without any need for adaptation or change.

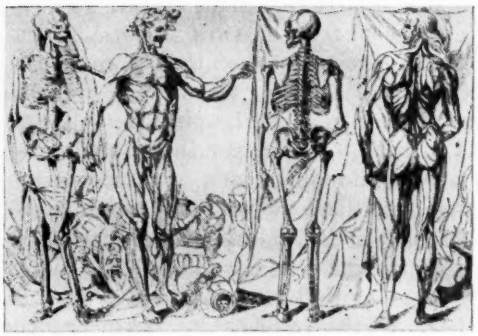
With Galen the end of Greek medicine arrived and the height of its achievement passed. The survival of Galen's works nevertheless insured a continuity of medical thinking, and it is hardly surprising that the earliest medieval physician appeared in the figure of a priest.

Although Galen's fame survived the Dark Ages and was never dimmed, not all of his writings shared their author's survival. Most of his anatomic treatises and his works concerning surgical experimentation were lost and had to be rediscovered during the Renaissance. The few

of his works that did survive contained least of the essence of his searching mind. They were dogmatic rather than scientific and thus appealed to the dogmatic minds of the medieval scholastics. To doubt Galen was tantamount to heresy and to be avoided by all means.

It took a complete change of intellectual atmosphere like that brought about by the Renaissance to cut through the thick veil of adoration that surrounded the traditional authorities.

Of the cultural factors that brought about the Renaissance the most important, perhaps, was the recovery of the original texts of the classics. Medievalism had abundant versions of classical texts, but the authors were obscured rather than clarified by too many translators, commentators and glossaries. Another factor contributing to the rebirth of thought was the expansion of Europe, the widened horizons that were the results of the Columbian voyages and, more specifically for medicine, the importation of new and important drugs. Finally, it was the invention of printing in 1450 that made the cultural achievements of the Renaissance possible. The Renaissance, thought of as a rebirth of the thought of antiquity, was destined to go beyond the Greeks and to lay the foundation of modern thought and method, especially in medicine and the related sciences. New thought, however, could not easily be substituted for old beliefs, and fierce struggles occurred between those who strove for advance and those whose security lay in the *status quo*. The spirit of the Renaissance was expressed by Niccolo Leoniceno, one of the earliest botanists, who said, "Why has nature given us our eyes and other senses unless we may rely upon ourselves in the search of what is true?" This dictum could easily have applied to the Renaissance anatomists and surgeons, for they were among the first to deviate from tradition and to use their eyes and their senses to discover what was true.



Anatomic sketch of two skeletons and two musclemen, after Rosso de Rossi, 1496-1541.

It is significant that the beginning of the study of human anatomy was made by one who was then and is now best known for his superb and unrivaled artistry. Leonardo da Vinci was a true humanist and a Renaissance personality in the most poignant sense of the term. His education combined philosophy with all other cultural subjects and medicine and the study of sciences with art. In his paintings his attention was often directed to the human body, and he felt that he could not do justice to the human body unless he understood it functionally and structurally. It was his plan, therefore, to write a textbook of anatomy; but, while many of his anatomic drawings have been preserved, they were less well known to his contemporaries than to us and of no influence on the anatomic thinking of his day. His textbook of anatomy was never published.

The real father of modern anatomy was Andreas Vesalius, who lived from 1514 to 1564. He was a Belgian from Wesel, from which he derived his name, and studied medicine at Louvain in Belgium and afterward in Paris. In both places he found the instruction utterly conservative and entirely based on Galen's anatomic texts.

Having dissected animals for his own enlightenment from his early youth, Vesalius became violently dissatisfied with the teaching of anatomy to which he was exposed, and in Paris he even went so far as to rush to a cadaver in the middle of an anatomic lecture and to take over the dissecting and demonstrating himself. This mutiny led to bitter quarrels with his teachers, and having obtained his degree he went to Italy and settled at Padua in 1537. At the age of 23 he was made Professor of Anatomy and immediately began instituting sweeping reforms. In contrast to the modern scholar who migrates to another country. Vesalius had no linguistic difficulties. The academic language was Latin, of which he, like all of his colleagues and students in every country, had fluent command. By untiring labor for five years he completed and printed his great work. At 28 he was the author of *De Fabrica Corporis Humani,* "On the Fabric of the Human Body," which was the first great modern work of science and the foundation stone of modern biology.

Vesalius deals with living anatomy, *anatomia animata,* and he fits the part under description into the living whole. Vesalius' figures are rarely diagramatic; they usually present parts of the body as in a living model. They are doubtless artistically far superior to modern anatomic representations. As the title of the book implies, Vesalius always saw the body as a fabric, that is, as a piece of workmanship fashioned by the Creator himself. Thus the muscles are shown as in living man. The modern biologist thinks of the origin of things and beings in terms of evolution. Vesalius thought of the need for which things and beings are made. He had revolted against Galen's thoughts and ideas, but like Galen, he thought that man was a work of art and God the artist.

Vesalius' "Fabric of the Human Body," published in 1543, opens with a description of bones and joints. The first bone considered is the skull. He describes the different shapes of the skull in the manner of the modern anthropologist. His most successful studies are concerned with the muscles. The drawings depicting the muscles are superior in certain aspects to most modern anatomic figures. Vesalius succeeded in showing muscles with a normal degree of contraction, for he represented living figures as though the skin were transparent.

The studies in which Vesalius proved himself as the greatest innovator, and in which he deviated completely from preceding thought, were his studies of the heart. It had been Galen's assumption that the presence of blood in both chambers of the heart could only be accounted for by assuming the existence of invisible pores in the septum of the heart. This belief had been implicitly shared by all subsequent teachers of medicine. Vesalius, in his various studies of animal and human hearts, was deeply puzzled. He was unable to find these pores, and he found the septum as dense and compact as the rest of the heart. In the first edition of his book in 1543 he expressed his puzzlement by stating,

> "The septum is formed from the very densest substance of the heart. It abounds on both sides with pits. Of these, none, so far as the senses can perceive, penetrate from the right to the left ventricle. We wonder at the art of the Creator which causes blood to pass from right to left ventricle through invisible pores."

This shows that Vesalius had begun to doubt Galen.

Twelve years later Vesalius brought out a second edition of his great work. Again he examined parts of the septum. He says, more strongly,

> "Not long ago I would not have dared to turn aside even a hair's breadth from Galen. But it seems to me that the septum of the heart is as thick, dense and compact as the rest of the heart. I do not see, therefore, how even the smallest particle can be transferred from the right to the left ventricle through the septum."

In addition to the "Fabrica," Vesalius was the author of several other works, all of which were written before he was in his early thirties. After this tremendous spurt of creative energy, however, his personal life came to a disappointing close. Little is known about his later though still youthful years. He left Padua under a cloud of persecution, having been accused of performing anatomic studies on living bodies. Much of this animosity was really occasioned by his controversial anatomic observations. From Padua he went to Spain to become the personal physician of Charles V, spending his last years in the quiet and obscurity of the Spanish court. He died on a voyage to Jerusalem of unexplained causes. The reason for his trip to the Holy Land is likewise unknown.

If we were to characterize the personalities that led to the flowering of surgery in the Renaissance we should, of course, begin with Vesalius, whom we would describe as the Observer. Vesalius, as we have seen, recorded his observations and brought out his new insight, which differed so much from that of earlier scientists, but on the whole he was content to observe and to record; he was unwilling to fight for the truths he had discovered. It took another personality who loudly and continuously voiced his criticism of unquestioning adherence to tradition and consequently brought upon himself the wrath of his medical contemporaries. This man, the Critic, was Paracelsus, also known as Philippus Aureolus Theophrastus Bombastus von Hohenheim. He was born in 1493 and died in 1542, two years before Vesalius published his "Fabrica."

Like many of the Renaissance personalities, Paracelsus was a man of wide general education and many interests, which included the entire realm of medicine, chemistry and surgery. Although his surgical writings were fewer than those in other fields, they were incisive and important because they aimed to do away with many of the ancient prejudices. Paracelsus was a learned man, but he was born in the rough mountains of Switzerland, and much of his work reflects his native surroundings more than the academic atmosphere in which he studied later but never felt entirely at home. He disdained the use of Latin, although he knew it, and was the first to use German

Anatomical drawings by Leonardo da Vinci, 1510.

for scientific writings. The German he used was rough and often uncouth, but it was emphatic and incisive and assured of great impact. Paracelsus collected his information not only from the lecture podium of the great professors but from barber-surgeons, bathhouse keepers and old wise women who collected herbs in the countryside. It is obvious from his writings that he, like his predecessors, was concerned mainly with the treatment of wounds rather than the practice of surgery in the modern sense of the word; but, it was in the treatment of wounds that he tried to introduce enormously important innovations.

Some of these innovations may appear to us like pure superstition and may have been born of superstition on Paracelsus' part. Still, their effect was destined to relieve a great deal of suffering. One of these innovations was the use of "weapon ointment." This ointment, which formerly had been applied to the wounds directly, was a concoction of weird and often unappetizing substances, retarding healing rather than promoting it, and often bringing about additional infection. It was Paracelsus' theory that if this ointment were to be applied to the weapon that had inflicted the wound rather than to the wound itself, healing would proceed at a faster rate, and one must admit that, while his theory may have been entirely wrong, his observation was certainly correct. Paracelsus furthermore violently opposed "the damnable precept which teaches that it is neccessary to make wounds suppurate." This was directed to the vast number of medieval and even Renaissance surgeons who had believed in "the laudable pus" or the healing "by second intention." Paracelsus' insistence on the cleanliness of wounds is found in various declarations that were truly revolutionary. Like Hippocrates he said, "In wounds nature is the real physician. All that is necessary is to prevent infection in wound diseases. The humors and complexion, diet, weather, and the stars have no influence. Only the proper treatment, that which lets nature act in peace, determines the result."

Eviscerated female figure made by Fialetti for the Italian Anatomist Giulio Casserio (1561-1616).

In the age of scholastic reasoning, of academic refinement and of the gentility of Latin phraseology, Paracelsus' course of unconcealed attack on his colleagues led to his defamation and persecution. The consequence was that his eminent medical colleagues saw to it that his books were not published and his dicta not respected. Nevertheless his message seeped through the curtain that was drawn around him and slowly became known among the people.

The experiences of Paracelsus, the Critic, and of Vesalius, the Observer, helped to instil caution into the third great figure of Renaissance surgery, Ambroise Paré. Paré, the Experimenter, was born in 1510 and died in 1590. He was entirely different from the two other medicosurgical heroes of the Renaissance. Vesalius and Paracelsus were well educated: Vesalius had laboriously demonstrated that Galen's facts were false. Paracelsus had rebelled against tradition and attacked Galen with violence. Paré was not educated. His incentive was not rebellion, it was not even the conscious desire for scientific observation, it was compassion for those who suffered. He was born in 1510 and had been apprenticed as a boy to a barber. During his apprenticeship he clipped the hair of his clients, he shaved and bled them, he pulled their teeth and dressed their wounds, and with all these ministrations he felt more and more attracted to surgery. In order to learn more about surgery, he went to the Hôtel Dieu (Hospital of God), which is still a place of refuge for those for whom society does not make other provisions. In Paré's days it was a dirty and totally neglected place, and the nursing staff, composed of sisters of charity, was entirely untrained. Each bed was occupied by several patients, and the operating room was in the corner of the vestibule. It was here that Paré received the beginnings of his surgical education.

In 1536 the war, which had helped Vesalius in his decision to leave Paris, called Paré into the Army. He became a regimental surgeon, and while the French laid siege to Turin Paré saw with helpless compassion how badly mutilated and wounded soldiers whom he could not help were relieved of their suffering by being shot by an old soldier. In the course of this campaign, which reached Milan, Paré introduced his first great innovations

From *De Corporis Humani Fabrica*, 1543, by Andreas Vesalius.

concerning the treatment of gunshot wounds. Gunshot wounds were the new features of warfare, as fearful and awesome as the newest weapons appear to us now.

Gunpowder had been invented in 1320 by Berthold Schwartz and guns and cannons were in general use in the fifteenth century. In the sixteenth century muzzle-loading arquebuses had been developed, which emitted balls of the size of a walnut and inflicted horrible wounds. The earlier weapons, swords, lances, and battle axes, had made clear, open wounds that were usually but slightly infected, but the gunshot wounds were deep and narrow; they usually contained bits of clothes and filth and led to severe infections.

Somewhat earlier Giovanni de Vigo, a

The Skeleton, from Godfried Bidloo's *Anatomia Humani Corporis*, Amsterdam, 1685.

leading scholarly writer on surgery and a physician to Pope Julius II, had stated categorically that gunshot wounds were poisoned with gunpowder. He recommended that, at the first dressing of these wounds, boiling hot oil be poured into the wounds in order to counteract the poisoning. Ambroise Paré was, of course, familiar with Giovanni de Vigo's writings and had without much hesitation followed the practice of using boiling oil. His implicit belief in this method was shattered after the experiences of his first major battle. While dressing the wounded, of whom there were many more than had been anticipated, he ran out of boiling oil and had to leave one-half of the wounded untreated. After a sleepless night during which he envisaged those untreated already dead or dying of their poisoning, he found a totally unexpected result. While those who had been treated with oil were feverish and in severe pain, and showed considerable swelling, he found the untreated ones on the way to recovery. Although it happened accidentally, this experience turned out to be the first controlled experiment in medical history. Paré himself recognized its value and repeated it later when trying out other innovations. In relation to the treatment with boiling oil, he implicitly believed in the evidence that presented itself to him and he stated; "Then I resolved with myself never more to burn thus cruelly poor men wounded with a gunshot." The fact that he trusted his own observation and reasoning and that he was immediately able to disregard authority and tradition is one of the indications of his great personality.

In 1545, after the conclusion of the Peace of Crespy, Paré returned to Paris and from then on alternated between private practice and military surgery. He also began his career as a medical writer. His first publication was "On the Treatment of Wounds of Firearms." This, like all his subsequent writings, was a practical textbook for surgeons. It did not theorize and was generally comprehensible, even to the less learned, because it was written in French.

Paré developed a number of new surgical methods. He introduced the ligature to be used instead of cautery with red hot irons in the control of hemorrhage following amputation. In antiquity the practice of ligature had been so well known that Galen had pointed out the shops where ligature materials of the best quality could be bought. The type of ligature used in modern surgery is directly derived from Paré. He was immensely skillful and in-

vented a number of prostheses: artificial eyes, and arms and legs which even had a mechanism to bring about their movement. He recommended and practiced postoperative massage and implanted teeth, which were taken from paid living donors.

It is interesting that this theory of the possibility of implanting teeth taken from donors persisted for several centuries after Paré. Even John Hunter practiced this method and wrote on it, expressing his complete conviction that teeth thus grafted would take root and be usable in their new environment. Altogether, most of Paré's inventions entered surgical practice sooner or later. Their impact was not as immediate as was to be expected, because of Paré's humble origin and the fact that he did not belong to the "inner circle" of scholars, but it is entirely owing to Paré that surgery became a skilled craft. Paré based his surgical operations on the anatomic writings of Vesalius and was thus the first surgeon to relate surgery to anatomy. Significantly, Paré had to keep his reliance on Vesalius' works a secret as long as Sylvius, Vesalius' teacher, was alive in Paris. Paré's position in the hierarchy of medicine was too uncertain for him to admit his spiritual fellowship with one who had disproved Galen. With the death of Sylvius this caution was no longer needed, and Paré's later writings rely openly on the works of Vesalius.

Paré's surgery remained the preferred mode of surgery for two hundred years, that is, until the arrival of the great surgical scientists of the eighteenth and nineteenth centuries. It took John Hunter to turn surgery into a science, Joseph Lister to introduce antisepsis to prevent infection, and the Americans, Long, Wells, and Morton, to provide the blessings of anesthesia and to abolish pain in operations. As was said earlier, Paré raised surgery from a trade followed by menials to a skilled craft carried out by trained men. After Paré's time, surgery became more and more a part of medical education, and the distinction between the "surgeons of the long robe" and the "surgeons of the short robe" was broken down. Surgery and the surgeon had become respectable.

Throughout his writings one cannot help to be impressed by Paré's gentleness and humility. Over and over again he stated his credo concerning his success with every one of his patients. "I dressed his wounds—God healed him," is his recurring summary of each recovery. His accidental use of the controlled experiment led him to perform others and to be inclined toward experimentation in general. Thus, when once called to treat a man whose face had been badly burned, Paré decided to try out a remedy of which he

Anatomic plate from the works of Pietro Berretini's *Tabulae Anatomicae*, Rome, 1741.

had heard through a camp-following old woman. She had recommended an application of chopped onions instead of the ointment that was generally used. In order to test this new remedy, he covered one half of the face of the burned man with the usual dressing and the other half with onion paste. Only when he found that the latter produced a more rapid cure did he use it altogether. Another experiment concerned the bezoar, which had been considered a theriac against poisoning since the earliest days of healing. The bezoar, selling for exorbitant prices and freely dispensed to many patients, was a stone-like ball consisting of hair and other matter which had been excreted by a goat or found in its stomach after its death. Paré gave portions of such stones to poisoned condemned prisoners, but soon found that the stone's value was purely mythical.

—ILZA VEITH, M.A., PH.D.

There are men who have made a business of abusing the sciences and, although they would not confess it themselves, their aim nevertheless is simply to display their own knowledge. But it seems to me that it is the aim and function of an intelligent mind to make new discoveries in whatever field such investigations may be useful, and also to bring to completion tasks that are but half-finished. On the other hand, a desire to belittle by abuse the scientific discoveries of others and to slander the discoveries of the learned to the illiterate, rather than to offer constructive criticism, is not so much the aim and function of an intelligent mind, as a proof of warped character and want of skill. Those who have the ambition to be scientists but not the necessary ability are equipped for the malicious habit of slandering their neighbors' work if it be right, or of censuring it if it be wrong. In other sciences, let those who can stop their enemies, each in his own subject. This thesis aims at answering the opponents of the science of medicine with a boldness to condemn based upon a sound knowledge of the subject it defends and upon the strength of trained judgment.

It appears to me that there is no science which has no basis in fact. It would be absurd to suppose something that exists non-existent. For what property of a non-existent thing could anyone point to as a proof of its existence?

—*Hippocrates*

New Books

Books Received.—The following books have been received by the Editor; they will be reviewed critically as space and facilities permit. Omission of more extended review, however, is not to be taken as criticism of the merit of the book.

L'Hemispherectomie (Hemispherectomy). By E. Laine and C. Gros. Paris: Masson et Cie, 1956. Pp. 134, with 31 illustrations.

Handbook of Physical Therapy. By Robert Shestack. New York: Springer Publishing Company, Inc., 1956. Pp. 212.

Atlas of Tumors of the Nervous System. By H. M. Zimmerman, Martin G. Netsky and Leo M. Davidoff. Philadelphia: Lea & Febiger, 1956. Pp. 191, with 277 illustrations (233 in color).

How to Enjoy Good Health. Edited by Cyril Solomon and Brooks Roberts. New York: Random House, 1956. Pp. 240.

Head Injuries and Their Management. By Francis Asbury Echlin. Philadelphia: The J. B. Lippincott Company, 1956. Pp. 127, with 10 illustrations.

Clinical Urology. By Oswald Swinney Lowsley and Thomas J. Kirwin. Baltimore: The Williams and Wilkins Company, 1956. 2 volumes, profusely illustrated; drawings by William Didusch.

The Stress of Life. By Hans Selye. New York: McGraw-Hill Book Company, Inc., 1956. Book V. Pp. 324.

Lesions of the Cervical Intervertebral Disk. Edited by Michael E. DeBakey and Barnes Woodhall. Springfield, Ill.: Charles C Thomas, Publisher, 1957. Pp. 134, with 41 illustrations. *Reviewed in this issue.*

Lymphatics, Lymph and Lymphoid Tissue. By Joseph Mendel Yoffey and Frederick Colin Courtice. Cambridge, Mass.: Harvard University Press (for the Commonwealth Fund), 1956. Pp. 510. Illustrated.

Operative Surgery. Edited by Charles Rob and Rodney Smith. London: Butterworth & Co., Ltd.; Philadelphia, F. A. Davis Co., 1956. Vols. 1 and 2 of 8 (plus index). Profusely illustrated.

Brain Mechanisms and Drug Action. By William S. Fields, Springfield, Ill.; Charles C Thomas, Publisher, 1957. Pp. 167, with 69 illustrations.

The Clinical Management of Varicose Veins. By David W. Barrow. New York: Paul B. Hoeber Inc., 1957. Pp. 167, with 70 illustrations.

Le Diagnostic du Cancer d'Estomac a la Periode Utile (Diagnosis of Carcinoma of the Stomach at the Time Most Favorable for Treatment). By Rene A. Gutmann. Paris: G. Doin et Cie, 1956. Pp. 257.

BOOKS REVIEWED

Chirurgie Orthopedique des Paralysies (Orthopedic Surgery of the Paralyses). By R. Merle D'Aubigne, J. Benassy and J. O. Ramadier. Paris: Masson et Cie, 1957. Pp. 431, with 171 illustrations.

The senior author of this reference book dealing with the orthopedic treatment of paralysis, Prof. R. Merle D'Aubigne of the Clinic of Orthopaedic Surgery of the Faculty of Medicine of Paris, is well known among the orthopedic surgeons of the United States. His judgment is much respected, and his ability and skill as a surgeon are admired by all who know him. With his collaborators, D'Aubigne has presented in this volume the methods and technics of diagnosing and treating each of the various types of paralysis of the spine or extremities.

Section 1 begins appropriately with a description of direct injuries of the peripheral nerves. The methods of suturing the injured nerves are shown; the indications for repair of the various nerves are outlined, and the results of suture of each of the more commonly injured nerves are presented in a study of the end results in a large series of cases. Special mention must be made of the section of the book that deals with injuries of the nerves that supply the muscles controlling movements of the hand. Both palliative and operative treatments are described. In addition to commonly recognized or standardized technics, many original modifications are described by the authors.

Section 2 consists of a section on painful neurovascular lesions or causalgias treated by sympathectomy. Section 3 describes the treatment of the traumatic paraplegias, including both conservative and surgical management. Section 4 recommends a program for the treatment of hemiplegia, and Section 5 presents both the nonoperative and the operative treatment of patients with cerebral palsy. Section 6 includes the treatment of the patient paralyzed from acute anterior poliomyelitis. The last chapter of the book describes clearly, but without being tiresome or tedious, electrodiagnosis of lesions of the peripheral nerves and their treatment by physiotherapy.

This is a reference book rather than a textbook. It should be available to those surgeons who are responsible for the diagnosis or the definitive treatment of paralysis of the extremities.

EDWARD L. COMPERE, M.D.

Lesions of the Cervical Intervertebral Disk. By Michael E. DeBakey, R. Glen Spurling and Barnes Woodhall. Springfield, Ill.: Charles C Thomas, Publisher. Pp. 134, with 41 illustrations.

This monograph has been carefully written and is subdivided into seven chapters, of which the second, on anatomic considerations, is especially good.

The third chapter covers the pathogenesis, the fourth discusses clinical diagnosis, the fifth chapter deals with roentgen diagnosis, and the sixth discusses the management of the various problems previously mentioned.

An excellent index and a comprehensive list of references are included. These should be helpful to anyone interested in this problem. The book should be read by all neurosurgeons and orthopedic surgeons.

H. E. TURNER, M.D.

Rectoscopy, Sigmoidoscopy. By R. Bensaude. Revised and edited by P. Hillemand, R. Cattan, A. Lambling and A. Bensaude. Paris: Masson et Cie, 1957.

The second edition of *Textbook on Rectoscopy* by R. Bensaude, which appeared in 1926, long has been exhausted. During the past thirty years many aspects of rectal pathology have changed considerable; some of them are completely modified: maladies formerly frequent have now become rare; rare maladies are better understood; novel treatments have been perfected.

Yet no comprehensive book, either within or without France, has been devoted to rectosigmoid endoscopy.

A group of pupils of the late master, therefore, has undertaken complete revision of the book. They have conserved his general plan, although certain chapters have been modified or recast and entirely new ones inserted to deal with all the new findings. The novel therapeutic applications by endo-rectal ways have been specified, particularly contact radiotherapy. The chapter on blood dyscrasias is completely new and has never before been published.

To the magnificent iconographic emplementation of the old edition have been added forty new aquarelles, taken from Bensaude's collection as well as from those of the editors. The number of pictures in black has been notably increased: radiologic aspects shown, as are the photographs of surgical pieces, specimens, histologic sections and endoscopic observations.

The 39 color plates, if published separately, would make a magnificent atlas in themselves. This collection is indispensable to every gastroenterologist, and it is particularly valuable for teaching purposes. The legends stand opposite each plate and are presented in French, English, Spanish, German, Italian and Portuguese.

M. T.

Gynecologic Therapy. By William Bickers. Springfield, Ill.: Charles C Thomas, Publisher, 1957. Pp. 158.

In spite of its title, this book presents clinical diagnosis as well as therapy. Surprisingly, there is no foreword or preface, and there are no illustrations. According to the advertising on the jacket, the book was written as a manual for senior medical students, residents and young general practitioners. The treatment recommended was chosen from the work of leading gynecologists as well as from the author's experience. The subjects covered are the vulva and introitus, the vagina, the cervix, the corpus, the fallopian tubes, the ovary, menstrual irregularities, dysmenorrhea and premenstrual tension, endometriosis, sterility, abortion, ectopic pregnancy, hydatidiform mole and chorionepithelioma, leukorrhea, hirsutism and intersexuality, and menopause and climacteric.

This book can be definitely recommended to the young men and women for whom it was written, because it contains authoritative information and advice based on the writings of leading gynecologists and the author's extensive personal experience as a practicing gynecologist, teacher and investigator.

J. P. GREENHILL, M.D.

Synopsis of Pathology. By W. A. D. Anderson. St. Louis: The C. V. Mosby Company, 1957, 4th ed. Pp. 829, with 328 illustrations and 12 color plates.

The fourth edition of this well known book follows, in its outline, the previous edition. As is to be expected from a scholar like Dr. Anderson, every chapter has been revised to keep in step with the latest knowledge in the field of pathology.

Considering the difficulties of condensing the tremendous field of pathology into a small synopsis, the reviewer must admire the result of the author's work. Needless to say, this synopsis is not intended to replace textbooks for students, but in the reviewer's opinion it represents a complete summary of the important features in general and special pathology.

The book is a "must" in the library of every pathologist and would be a valuable addition to that also of every physician interested in the basic principles of medicine.

WERNER F. EISENSTAEDT, M.D.

The Treatment of Fractures. By Lorenz Böhler. New York and London: Grune & Stratton, Inc., 1957. 5th ed., vol. 2. Pp. 435, with 941 illustrations.

Volume 2 of the fifth edition of this impressive set of reference books, dealing with fractures and other injuries of the spine and extremities, was translated from the thirteenth German edition by Otto Russe, M. D., Director of the Accident Hospital of Vienna, where most of Böhler's work has been carried on for many years, and by R. G. B. Bjornson, M. D., who is listed as a Diplomate of the American Board of Radiology.

This book is devoted entirely to the diagnosis and treatment of fractures or disloca-

tions of the hip and fractures of the shaft of the femur. In addition to a number of line drawings and abundant reproductions of roentgenograms, there are many photographs of the animation type, showing the patient in various positions to indicate the restoration of joint function after injuries of the femoral neck and shaft.

The treatment described includes internal fixation by various technics. The complications that may result from the injuries to the hip or the shaft of the femur are presented most effectively. Chapter 52 is devoted to the subject of the management of gunshot wounds of the hip joint, and the final chapter in the book describes the treatment recommended for both recent and old or infected gunshot wounds of the shaft of the femur.

Probably no one in the world has had a more varied or extensive experience in the treatment of various types of fractures than has Lorenz Böhler. The methods he recommends are those which have proved most successful when carried out by Böhler or under his own supervision. Although many who read the book will disagree with some of his recommendations, no orthopedic or industrial surgeon who is called upon to treat fractures and dislocations of the femur will wish to be without this reference book.

EDWARD L. COMPERE, M.D.

L'Hemorrhagie Cerebrale (Cerebral Hemorrhage). By Guy Lazorthes. Paris: Masson et Cie, 1956. Pp. 112, with 26 illustrations.

This study is based on the author's experience with 45 spontaneous (nontraumatic) cerebral hematomas. In 17 patients the hematoma was considered due to hypertension, in 2 to endocarditis, in 1 to lood dyscrasia, in 5 to aneurysm, in 5 to angioma and in 15 to an undetermined cause. Thirty-five of the patients have been seen in the past five years. All but 1 of these were operated on, with only 6 deaths (15 per cent). The essential details of these 35 cases are presented in tabular form.

The location was parieto-occipital in 26 of the 35 patients; frontal in 3; temporal in 2, and deep or capsular in 4.

Angiographic study is considered to be the diagnostic procedure of choice.

Operation is best carried out toward the end of the first week. Craniotomy with incision of the cortex and evacuation of the clot under direct vision is the preferred procedure.

The literature is thoroughly reviewed and an extensive bibliography appended. The therapeutic emphasis is on surgical removal of the hematoma but medical management, especially induced hypotension and hypothermia, is not neglected.

HAROLD C. VORIS, M.D.

The most important thing in a work of art is that it should have a kind of focus, i.e. there should be some place where all the rays meet or from which they issue. And this focus must not be able to be completely explained in words. This indeed is one of the significant facts about a true work of art—that its content in its entirety can be expressed only by itself.

A really remarkable and powerful mind can look for a method of expressing his idea, and if the idea is strong he will find new methods of expressing it. But modern artists invent a technical method and then are on the lookout for an idea, which they arbitrarily squeeze into their method.

—*Tolstoy*

Abstracts from Current Literature

Primary Malignant Neoplasms of the Duodenum. Ochsner, S., and Kleckner, M. S. Jr., J.A.M.A. 163:413, 1957.

Only radiologic diagnosis can provide early enough recognition of tumors involving the duodenum to allow resection of the lesion. While the radiologist must be particularly alert to the less common lesions of the alimentary tract, he must be equally aware of the factors that may obscure the lesions during the examination.

Of 17 duodenal lesions observed at the Ochsner Clinic, 14 were diagnosed as adenocarcinoma and 3 as sarcoma.

The tumors were classified into suprapapillary, peripapillary, and infrapapillary types, each of which has rather characteristic clinical manifestations.

Prompt surgical exploration and excision or palliative procedures should be carried out.

WILLIAM E. NORTH, M.D.

Pulmonary Cystic Disease: Physiologic Studies and Results of Resection. Siebens, A. A.; Grant, A. R.; Kent, D. C.; Klopstock, R., and Cinotti, J. J., J. Thoracic Surg. 33: 185, 1957.

Pulmonary cystic disease is discussed from the standpoint of interpretation of pulmonary functional tests, variability in physiologic deficit and end results of excisional therapy. Six cases are reported in detail. No characteristic abnormality accompanies pulmonary cystic disease. Large cysts may produce minimal or extensive physiologic deficits. The patency of the communication, the index of alveolar mixing and the degree of compression of the surrounding normal lung are important factors in determining the ultimate prognosis. Excisional therapy of the cysts produces excellent results from both the symptomatic and the physiologic point of view.

ERNEST G. DEBAKEY, M.D.

Pneumoperitoneum as a Space-Occupying Procedure in Conjunction with Pulmonary Resection. Buechner, H. A.; Ziskind, M. M., and Strug, L. H., J. Thoracic Surg. 33:229, 1957.

In the authors' opinion a "space-occupying procedure" is not necessary after pulmonary resection from the standpoint of preventing overdistention of the remaining lung but should be considered in order to preserve pulmonary function, eliminate dead space and prevent reactivation of residual foci of tuberculosis. They are convinced that artificial pneumoperitoneum will serve this purpose. They found this procedure is selective, produces no deformity or complications and is simple to perform. It is instituted several weeks before the operation and two weeks thereafter and is maintained for two months.

ERNEST G. DEBAKEY, M.D.

Proctosigmoidoscopy: Incidence of Polyps in 50,000 Examinations. Portes, C., and Majarakis, J. D., J.A.M.A. 163:411, 1957.

Proctosigmoidoscopic study was accomplished in 50,000 cases, with 1 instance only of perforation, by observing these precautions: digital examination of the rectum before inserting the instrument, blind insertion of the instrument only as far as the finger had explored, infrequent use of air inflation, special care in passing diseased segments, and care not to push the instrument forcibly against the intestinal wall until the lumen ahead had been identified. All subjects were asymptomatic and between the ages of 20 and 76. Polyps were observed in 3,952 cases. Of these, 328 were malignant. In addition, 19 instances of moderately advanced rectal carcinoma were noted.

Digital examination and proctosigmoidoscopic study are effective in the early detection of malignant neoplasm. The early removal of rectal polyps will prevent many carcinomas of the colon.

WILLIAM E. NORTH, M.D.

IMPORTANT ANNOUNCEMENT

Contributors of scientific articles for publication in The Journal of the International College of Surgeons from Europe, the Near East and the Middle East should send their articles to:

European Office of the
International College of Surgeons
6-8 Rue de la Confederation
Geneva, Switzerland

A special committee has been appointed to evaluate the papers submitted for publication. The Journal publishes summaries in English, French, German, Spanish, Italian and Portuguese. Summaries of articles should be included in as many of these languages as possible.

AVIS IMPORTANT

Les auteurs d'articles scientifiques destinés à être publiés dans le Journal du Collège international de chirurgiens sont priés d'adresser leurs articles à l'adresse suivante pour l'Europe, le Proche et le Moyen Orient.

Bureau Européen du
Collège international de chirurgiens
6-8 rue de la Confédération
Genéve (Suisse)

Un comité a été nommé pour l'examen des articles à paraître. Les auteurs sont priés de joindre à leur travail de brefs résumés en français, anglais, allemand, espagnol, italien et portugais si possible.